HEIDENHAIN

TNC 320

The Compact Contouring Control for Milling, Drilling and Boring Machines

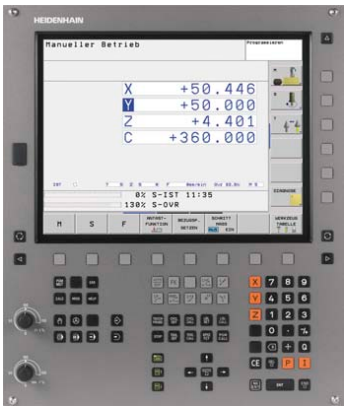
Information for the Machine Tool Builder

September 2012

TNC contouring control from HEIDENHAIN
General information

TNC 320

- Contouring control for **milling machines**
- Up to 5 axes and closed-loop main spindle
- Analog command interface to the drives (± 10 V)
- Compact design: Screen, keyboard and computer all in one unit
- Dimensions: 400 mm x 470 mm x 100 mm
- Integrated 15-inch TFT color flat-panel display
- Storage medium for NC programs: CompactFlash memory card
- Programming in HEIDENHAIN conversational language
- Standard milling, drilling and boring cycles
- Touch probe cycles
- Short block processing time



System test

Controls, motors and encoders from HEIDENHAIN are in most cases integrated as components in larger systems. In these cases, comprehensive tests of the complete system are required, irrespective of the specifications of the individual devices.

Expendable parts

In particular the following parts in controls from HEIDENHAIN are subject to wear:

- Buffer battery
- Fan

Standards

Standards (ISO, EN, etc.) apply only where explicitly stated in the catalog.

Note

Microsoft Windows, Windows 2000, Windows XP, Windows Vista, Windows 7 and the Internet Explorer are registered trademarks of Microsoft Corporation.

Validity

The features and specifications described here apply for the following control and NC software versions:

TNC 320 with NC software version
340551-06 (no export license required)

This catalog supersedes all previous editions, which thereby become invalid. **Subject to change without notice.**

Prerequisites

Some of these specifications require particular machine configurations. Please note also that, for some functions, a special PLC program must be created by the manufacturer.

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Overview tables

Overview of TNC 320 components

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Main computer	**MC 320**	12
Storage medium	**CFR** CompactFlash memory card	12
NC software license	On **SIK component**	12
Visual display unit	15-inch color flat-panel display (integrated)	
Operating panel	Integrated	
Machine operating panel	**MB 420**	15
Encoder input board	Necessary as of 4 axes and closed-loop spindle	13
Connecting cables	✓	23

Accessories

Accessories	TNC 320	Page
Electronic handwheels	• **HR 410** portable handwheel or • **HR 520** portable handwheel with display or • **HR 550 FS** portable wireless handwheel with display or • **HR 130** panel-mounted handwheel or • Up to three **HR 150** panel-mounted handwheels via HRA 110 handwheel adapter	19
Workpiece touch probes	• **TS 220** touch trigger probe with cable connection or • **TS 440** touch trigger probe with infrared transmission or • **TS 444** touch trigger probe with infrared transmission or • **TS 640** touch trigger probe with infrared transmission or • **TS 740** touch trigger probe with infrared transmission	17
Tool touch probes	• **TT 140** touch trigger probe or • **TS 449** touch trigger probe with infrared transmission or • **TL Nano** laser system for contact-free workpiece measurement or • **TL Micro** laser system for contact-free workpiece measurement	18
PLC input/output system	For additional internal PLC inputs and outputs **PL 510** consisting of PLB 51x basic module and I/O modules	16
USB hub	✓	40
Programming station	Control software for PCs for programming, archiving, and training • Single-station license with original control keyboard • Single-station license with virtual keyboard • Network license with virtual keyboard • Demo version with virtual keyboard or PC keyboard—free of charge	*)
Snap-on keys		22

*) For further information, refer to the *TNC Programming Station* brochure.

Accessories / Software	TNC 320	Page
PLCdesign[1)]	PLC development software	36
KinematicsDesign[1)]	Software for creating kinematics and initializing DCM	31
TNCremo[2)]	Data transfer software	40
TNCremoPlus[2)]	Data transfer software with "live" screen	40
ConfigDesign[1)]	Software for configuring the machine parameters	33
CycleDesign[1)]	Software for creating cycle structures	38
Software Key Generator[1)]	Software for enabling SIK options for a limited time	12
TNCscope[1)]	Software for data recording	33
TeleService[1)]	Software for remote diagnostics, monitoring, and operation	34
RemoTools SDK[1)]	Function library for developing customized applications for communication with HEIDENHAIN controls	41

1) Available to registered customers for downloading from the Internet
2) Available to all customers (without registration) for downloading from the Internet

Specifications

Specifications	TNC 320	Page
Axes	3 closed-loop axes, optional: 4th and 5th axis	25
PLC axes	✓	25
Central drive	✓	25
Open-loop axes	✓	25
Spindle	Max. 2; second spindle can be controlled alternately with the first	
Analog nominal speed value	Up to 100 000 min^{-1}	27
Digital control over PLC outputs	✓	
Position-controlled spindle	✓	27
Oriented spindle stop	✓	27
Gear shifting	✓	27
NC program memory		
Input resolution and display step		
Linear axes	0.1 µm	25
Rotary axes	0.0001°	25
Interpolation		
Straight line	4 of 5 axes	*
Circle	2 of 5 axes	*
Helix	✓	*
Axis feedback control	Analog speed command interface ± 10 V (X8)	29
With following error	✓	
With feedforward	✓	
Cycle times		
Block processing	6 ms	29
Path interpolation	3 ms	
Permissible temperature range	Operation: In electrical cabinet: 5 °C to 40 °C In operating panel: 0 °C to 50 °C Storage: –20 °C to 60 °C	

* For further information, refer to the *TNC 320* brochure

Machine interfacing

Machine interfacing	TNC 320	Page
Error compensation	✓	32
Linear axis error	✓	32
Nonlinear axis error	✓	32
Backlash	✓	32
Thermal expansion	✓	32
Integrated PLC	✓	35
Program format	Statement list	35
Program input on the TNC	Via external USB keyboard	35
Program input via PC	✓	35
Symbolic PLC-NC interface	✓	35
PLC memory	50 MB	35
PLC cycle time	Typically 21 ms, adjustable	35
PLC inputs, 24 V DC[1)]	31 (expandable via PL); additional 25 on machine operating panel	16
PLC outputs, 24 V DC[1)]	31 (expandable by PL)	16
Analog inputs, ± 10 V	Via PL	16
Inputs for PT 100 thermistors	Via PL	16
Analog outputs, ± 10 V	Via PL	16
PLC functions	✓	35
Small PLC window	✓	35
PLC soft keys	✓	35
PLC positioning	✓	36
PLC basic program	✓	37
Integration of applications		36
High-level language programming	Python programming language used in combination with the PLC (option 46)	36
User interfaces can be custom-designed	Inclusion of specific user interfaces from the machine tool builder (option 46)	36

[1)] Further PLC inputs/outputs via PL 510 for connection to MC

Machine interfacing	TNC 320	Page
Commissioning and diagnostic aids		33
ConfigDesign	Software for creating the machine configuration	33
Integrated oscilloscope	✓	33
Trace function	✓	34
API DATA function	✓	34
Table function	✓	34
OnLine Monitor (OLM)	✓	33
Log	✓	34
TNCscope	✓	33
Commissioning wizard	For analog axes	
Data interfaces	✓	
Ethernet (100 BaseT)	✓	39
USB 2.0	2 on the rear, 1 on the front	39
RS-232-C/V.24	✓	39
Protocols		39
Standard data transfer	✓	39
Blockwise data transfer	✓	39
LSV2	✓	39
Encoder inputs		28
Position	4 (optional: 5)	28
Incremental	1 V_{PP}	28
Absolute	EnDat 2.1	28

[1] Further PLC inputs/outputs via PL 510 for connection to MC

User functions

User function	Standard	Option	TNC 320
Brief description	✓		Basic version: 3 axes plus spindle
		0	1st additional axis for 4 axes and closed-loop or open-loop spindle
		1	2nd additional axis for 5 axes and open-loop spindle
Program entry	✓		HEIDENHAIN conversational
	✓		DIN/ISO via soft keys or via external USB keyboard
Position entry	✓		Nominal positions for lines and arcs in Cartesian coordinates or polar coordinates
	✓		Incremental or absolute dimensions
	✓		Display and entry in mm or inches
Tool compensation	✓		Tool radius in the working plane and tool length
	✓		Radius-compensated contour look-ahead for up to 99 blocks (M120)
Tool tables	✓		Multiple tool tables with any number of tools
Constant contour speed	✓		Relative to the path of the tool center
	✓		Relative to the tool's cutting edge
Parallel operation	✓		Creating a program with graphical support while another program is being run
Rotary table machining		8	Programming of cylindrical contours as if in two axes
		8	Feed rate in distance per minute
Contour elements	✓		Straight line
	✓		Chamfer
	✓		Circular path
	✓		Circle center point
	✓		Circle radius
	✓		Tangentially connecting circular arc
	✓		Corner rounding
Contour approach and departure	✓		Via straight line: tangential or perpendicular
	✓		Via circular arc
FK free contour programming	✓		FK free contour programming in HEIDENHAIN conversational format with graphic support for workpiece drawings not dimensioned for NC
Fixed cycles	✓		Drilling, tapping with a floating tap holder, rigid tapping
	✓		Rectangular and circular pockets
	✓		Peck drilling, reaming, boring, counterboring, centering
	✓		Milling internal and external threads
	✓		Clearing level and oblique surfaces
	✓		Multioperation machining of straight and circular slots
	✓		Multioperation machining of rectangular and circular pockets
	✓		Cartesian and polar point patterns
	✓		Contour train, contour pocket
	✓		OEM cycles (special cycles developed by the machine tool builder) can be integrated
	✓		Engraving cycle: Engrave text or numbers in a straight line or on an arc

User function	Standard	Option	TNC 320
Program jumps	✓		Subprograms
	✓		Program-section repeat
	✓		Calling any program as a subprogram
Coordinate transformation	✓		Datum shift, rotation, mirror image, scaling factor (axis-specific)
		8	Tilting the working plane, PLANE function
Q parameters Programming with variables	✓		Mathematical functions =, +, –, *, /, sin α, cos α, tan α, arc sin, arc cos, arc tan, a^n, e^n, ln, log, angle α of sin α and cos α, square root of a, square root of $(a^2 + b^2)$
	✓		Logical operations (=, = /, <, >)
	✓		Calculating with parentheses
	✓		Absolute value of a number, constant π, negation, truncation of digits before/after decimal point
	✓		Functions for calculation of circles
Programming aids	✓		Calculator
	✓		Complete list of all current error messages
	✓		Context-sensitive help function for error messages
	✓		TNCguide: The integrated help system. User information available directly on the TNC
	✓		Graphic support for programming cycles
	✓		Comment and structure blocks in the NC program
Actual position capture	✓		Actual positions can be transferred directly into the NC program
Test graphics Display modes	✓		Graphic simulation before a program run, even while another program is running
	✓		Plan view / projection in 3 planes / 3-D view, also in tilted working plane
	✓		Magnification of details
Interactive programming graphics	✓		In the Programming and Editing mode, the contour of the NC blocks is drawn on screen while they are being entered (2-D pencil-trace graphics), even while another program is running
Progr.-run graphics Display modes	✓		Graphic simulation during real-time machining
	✓		Plan view / projection in 3 planes / 3-D view
Machining time	✓		Calculation of machining time in the Test Run operating mode
	✓		Display of the current machining time in the Program Run operating modes
Returning to the contour	✓		Mid-program startup in any block in the program, returning the tool to the calculated nominal position to continue machining
	✓		Program interruption, contour departure and return
Datum managem.	✓		For saving any reference points
Datum tables	✓		Several datum tables for storing workpiece-related datums
Touch probe cycles	✓		Touch probe calibration
	✓		Compensation of workpiece misalignment, manual or automatic
	✓		Datum setting, manual or automatic
	✓		Automatic tool and workpiece measurement
Parallel secondary axes	✓		Compensating movement in the secondary axis U, V, W through the principal axis X, Y, Z
	✓		Including movements of parallel axes in the position display of the associated principal axis (sum display)
	✓		Defining the principal and secondary axes in the NC program makes it possible to run programs on different machine configurations
Conversational languages	✓		English, German, Chinese (traditional, simplified), Czech, Danish, Dutch, Finnish, French, Hungarian, Italian, Polish, Portuguese, Russian (Cyrillic), Spanish, Swedish
		41	For more conversational languages, see Options

Options

Option number	Option	As of NC software 34055x-	ID	Comment
0	Additional axis	01	ID 354540-01	Additional control loop 1
1	Additional axis	01	ID 353904-01	Additional control loop 2
8	Software option 1	01	ID 536164-01	**Rotary table machining** • Programming of cylindrical contours as if in two axes • Feed rate in distance per minute
		03		**Interpolation** • Circular in 3 axes with tilted working plane **Coordinate transformation** • Tilting the working plane
		04		PLANE function
18	HEIDENHAIN DNC	01	ID 526451-01	Communication with external PC applications over COM component
24	Gantry axes	04	ID 634621-01	Gantry axes in master-slave torque control
41	Additional language	01	ID 530184-01 ID 530184-02 ID 530184-03 ID 530184-04 ID 530184-06 ID 530184-07 ID 530184-08 ID 530184-09 ID 530184-10	Additional conversational language: Slovenian Slovak Latvian Norwegian Korean Estonian Turkish Romanian Lithuanian
46	Python OEM process	01	ID 579650-01	Python application on the iTNC

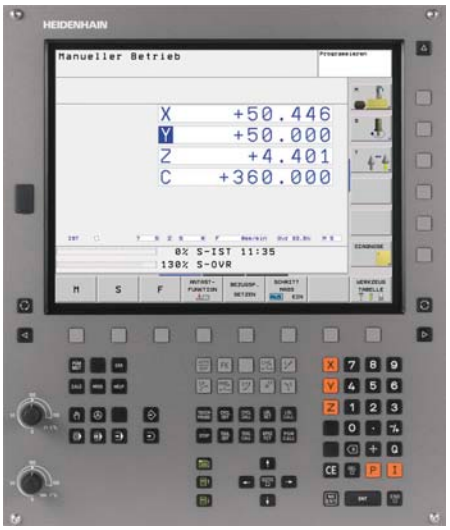
Control components
Main computer

TNC 320

The standard version of the TNC 320 features four inputs for position encoders. It can be enhanced with options.

The TNC 320 includes the MC 320 main computer with:
- Processor (INTEL® Celeron M, 1 GHz)
- 1 GB SDRAM main memory
- 15-inch TFT color flat-panel display; resolution 1024 x 768 pixels
- TNC keyboard
- PLC
- Interface to handwheel and touch probes
- Further interfaces (PLC expansion, Ethernet, USB 2.0, RS-232-C/V.24)

To be ordered separately, and installed in the main computer by the OEM:
- **CFR** CompactFlash memory card with the NC software
- **SIK component** (System Identification Key) for enabling control loops and options



MC 320

	Position inputs	4 x 1 V_{PP} or EnDat (optional 5 x 1 V_{PP} or EnDat)
	Weight	7.9 kg ID 511442-xx
Power supply	Power supply	85 V AC to 264 V AC
	Frequency	47 Hz to 440 Hz
	Power consumption	60 W

Storage medium

A CFR (= CompactFlash Removable) compact flash memory card is used as storage medium. It contains the NC software and is used to store NC and PLC programs. The storage medium is removable and must be ordered separately from the main computer.

CFR CompactFlash

Free capacity for NC programs	300 MB
Free capacity for PLC programs	50 MB
No export license required	ID 537067-51

CFR CompactFlash

SIK component

The SIK component contains the **NC software license** for enabling control loops and software options. It gives the main computer an unambiguous ID code—the SIK number. The SIK component is ordered and shipped separately. It must be inserted in a special slot on the side of the TNC 320.
The SIK component with the NC software license is available in various versions, depending on the enabled control loops and options. Further control loopscan be enabled later by entering a keyword. HEIDENHAIN provides the keyword, which is based on the SIK number.

When ordering, please indicate the SIK number of your control. When the keywords are entered in the control, they are saved in the SIK component. This enables and activates the options. Should service become necessary, the SIK component must be inserted in the replacement control to enable all required options.

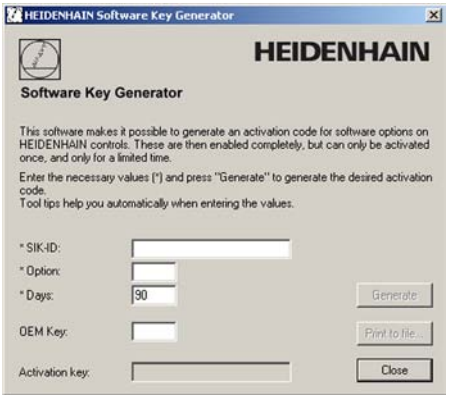
SIK component

Master keyword (general key)

There is a master keyword (general key) for putting the TNC 320 into service that will unlock all options for a duration of 90 days. After this period, only those options with the correct keywords will be active. The general key is activated via a soft key.

Software Key Generator (accessory)

The PC software makes it possible to generate an activation code for software options on HEIDENHAIN controls. The selected option is enabled for a limited time (10 to 90 days). It can only be enabled once. You generate the desired activation code by entering the SIK number, the option to be enabled, the duration and a manufacturer-specific password. Option enabling is independent of the general key.


HEIDENHAIN Software Key Generator
HEIDENHAIN
Software Key Generator
This software makes it possible to generate an activation code for software options on HEIDENHAIN controls. These are then enabled completely, but can only be activated once, and only for a limited time.
Enter the necessary values (*) and press "Generate" to generate the desired activation code.
Tool tips help you automatically when entering the values.
* SIK-ID:
* Option:
* Days:
90
Generate
OEM Key:
Print to file...
Activation key:
Close

NC software license

SIK with software license and enabling for

4 control loops (3 axes and closed-loop spindle)	ID 533093-51
5 control loops (4 axes and closed-loop spindle)	ID 533093-52

Axis options

With the NC software license for three axes, two additional control loops can be enabled retroactively:

1st additional axis	ID 354540-01
2nd additional axis	ID 353904-01

Encoder input board

An additional encoder input board is required for configurations with five or more closed control loops.

Encoder input board	ID 554296-xx

Possible configurations

Closed-loop axes	Spindle	NC software license for	Necessary options
3	Closed-loop	4 control loops	–
4	Open-loop	4 control loops	1st additional axis
		5 control loops	–
4	Closed-loop	4 control loops	1st additional axis Encoder input board
		5 control loops	Encoder input board
5	Open-loop	4 control loops	1st additional axis 2nd additional axis Encoder input board
		5 control loops	2nd additional axis Encoder input board
5	Closed-loop	4 control loops	1st additional axis 2nd additional axis 2 encoder input boards
		5 control loops	2nd additional axis 2 encoder input boards

[1] For the *open-loop spindle*, the TNC commands an analog nominal speed value for the spindle speed. For the *closed-loop spindle*, position feedback is provided, for example for oriented spindle stop.

Options

The capabilities of the TNC 320 can also be adapted retroactively with options to meet new requirements. These options are described on page 11. They are enabled by entering keywords based on the SIK number, and are saved in the SIK component. Please indicate your SIK number when ordering new options.

TNC keyboard

The keys for the axes Z, 4 and 5 are designed as snap-on keys and can be replaced by keys with other symbols (see Snap-on keys).

Export license

An **export license** is generally **not required** for the TNC 320 because the NC software limits the number of interpolatable axes to four. The 5th axis can be used for the spindle or as an auxiliary axis.

Machine operating panel

MB 420 machine operating panel

- 21 snap-on keys, freely definable via PLC
- Operating elements
  Assigned according to PLC basic program with:
  Control voltage on; Emergency stop; NC start; NC stop;
  5 axis keys; Rapid traverse; Retract axis; Tool change;
  Unclamp tool; Menu selection; Unlock door;
  Spindle start; Spindle stop; Coolant; Rinse-water jet;
  Chip removal (for further symbol keys, see Snap-on keys)
- Additional connections
  Terminals for 3 PLC inputs and 8 PLC outputs

MB 420 ID 293757-45
Weight 0.9 kg

MB 420

PL 510 PLC input/output system

PL 510

If the PLC inputs/outputs of the control do not suffice, additional PL 51x PLC input/output systems can be connected. These external modular I/O systems consist of a PLB 51x basic module and one or more PLD 16-8 and PLA 4-4 input/output modules.

PL 510

Basic modules

Basic modules feature slots for 4, 6 or 8 I/O modules. They are mounted on standard NS 35 rails (DIN 46 227 or EN 50 022).

Power supply	24 V DC
Power consumption	Approx. 20 W
Weight	0.36 kg (bare)

Basic modules with HEIDENHAIN PLC interface

PLB 510	Slots for 4 I/O modules	ID 358849-01
PLB 511	Slots for 6 I/O modules	ID 556941-01
PLB 512	Slots for 8 I/O modules	ID 557125-01

Up to four PLB 510 modules, and up to two PLB 511 or PLB 512 modules can be connected to the control. The maximum cable length to the last PLB 51x is 30 m.

I/O modules

The I/O modules consist of one module with digital inputs/outputs and one analog module. For partially occupied basic modules, the unused slots must be occupied by an empty housing.

PLD 16-8 ID 360916-11
I/O module for PL 5x0 with
16 digital inputs and
8 digital outputs.
The maximum power output per module is 200 W. A load of up to 2 A can be placed on each output. No more than four outputs may be loaded with 2 A at any given time.
Weight 0.2 kg

PLA 4-4 ID 366423-01
Analog module for PL 5x0 with
4 analog inputs for PT 100 thermistors
4 analog inputs for ± 10 V
Weight 0.2 kg

Empty housing

For unused slots ID 383022-11

Accessories
Touch probes

Overview

Before the TNC 320 leaves the factory, it is already prepared for the use of touch probes for workpiece or tool measurement. These touch probes generate a trigger signal that saves the current position value to the NC. For more information on the touch probes, ask for our brochure or CD-ROM titled *Touch Probes*.

Workpiece measurement

The TS touch trigger probes have a stylus for probing workpieces. The HEIDENHAIN controls provide standard routines for datum setting and workpiece measurement and alignment. The touch probes are available with various taper shanks. Assorted styli are available as accessories.

Touch probe with **cable connection for signal transmission** for machines with manual tool change:

TS 220 — Touch probe for NC machines

TS 220

Touch probe with **infrared signal transmission** for machines with automatic tool change:

TS 440 — Compact dimensions

TS 444 — Compact dimensions, battery-free—power supply through integrated air turbine generator over central compressed air supply

TS 640 — Standard touch probe with wide-range infrared transmission and long operating time

TS 640

TS 740 — High probing accuracy and reproducibility, low probing force

SE transmitter-receiver unit — The infrared transmission is established between the TS touch probe and the SE transceiver unit. The following SE units can be combined with the TS touch probes:
SE 640 for installation in the machine's working space
SE 642 common SE for TS and TT 449; otherwise same as SE 640
SE 540 for installation in the spindle head

SE 640

Tool measurement

The touch probes for tool measurement from HEIDENHAIN are suited for probing stationary or rotating tools directly on the machine. The TNC 320 has standard routines for measuring length and diameter of the tool as well as the individual teeth. The TNC 320 automatically saves the results of measurement in a tool table. It is also possible to measure tool wear between two machining steps. The TNC 320 compensates the changed tool dimensions automatically for subsequent machining or replaces the tool after a certain limit—as for example after tool breakage.

With the triggering **TT touch probes** the disk-shaped contact plate is deflected from its rest position upon contact with a stationary or rotating tool, sending a trigger signal to the TNC 320 control.

TT 140 — Signal transmission to the control over connecting cable

TT 140

TT 449 — Signal transmission over infrared beam to SE 642 transmitter/ receiver unit

TL Micro/TL Nano — The **TL laser systems** operate without any contact. A laser beam probes the length, diameter or contour of the tool. Special measuring cycles in the TNC 320 evaluate the information.

TL Micro 150, TL Micro 300

Electronic handwheels

Overview

The standard TNC 320 supports the use of electronic handwheels.
- **HR 550 FS** wireless handwheel, or
- **HR 410** or **HR 520** portable handwheel, or
- **HR 130** panel-mounted handwheel
- Up to three **HR 150** panel-mounted handwheels via **HRA 110**

HR 410

Portable electronic handwheel with
- Keys for the selection of 5 axes
- Traverse direction keys
- Keys for three preset feed rates
- Actual-position-capture key
- Three keys with machine functions (see below)
- Two permissive buttons (24 V)
- Emergency stop button (24 V)
- Magnetic holding pads

All keys are designed as snap-on keys and can be replaced by keys with other symbols (see *Snap-on keys*).

	Keys	W/o detent	With detent
HR 410	FCT A, FCT B, FCT C	ID 296469-53	–
	Spindle right/left/ stop	ID 296469-54	–
	NC start/stop, spindle start (for PLC basic program)	ID 296469-55	ID 535220-05

Weight approx. 1 kg

HR 410

HR 520

Portable electronic handwheel with
- Display for operating mode, actual position value, programmed feed rate and spindle speed, error messages
- Override potentiometer for feed rate and spindle speed
- Selection of axes via keys or soft keys
- Actual position capture
- NC start/stop
- Spindle on/off
- Keys for continuous traverse of the axes
- Soft keys for machine functions of the machine manufacturer
- Emergency stop button

	W/o detent	With detent
HR 520	ID 670302-01	ID 670303-01

Weight approx. 1 kg

HR 520

Mount for HR 520

For fastening on machine ID 591065-02

HR 550 FS

Electronic handwheel with wireless transmission. Display, operating elements and functions same as HR 520.

In addition:
- Functional safety
- Wireless transmission range up to 20 m (depending on environment)

HR 550 FS	W/o detent	ID 598515-03
	With detent	ID 606622-03

HR 550 FS with HRA 551 FS

HRA 551 FS

Handwheel mount for HR 550 FS
- For docking the HR 550 FS on the machine
- Integrated charger for HR 550 FS
- Connections to the control and the machine
- Integrated transceiver unit

HRA 551 FS	ID 731928-02
Weight	Approx. 1.0 kg

For more information, see the *HR 550 FS* Product Information sheet.

Connecting cable

	For HR 410/HR 520	For HR 550 FS with HRA 551 FS	
Connecting cable (spiral cable) to HR (3 m)	✓	–	ID 312879-01
Connecting cable with metal armor	✓	–	ID 296687-xx
Connecting cable without metal armor	✓	✓	ID 296467-xx
Adapter cable for HR/HRA to MC	✓	✓[1)]	ID 296466-xx
Extension cable to adapter cable	✓	✓[1)]	ID 281429-xx
Adapter cable for HRA to MC	–	✓[2)]	ID 749368-xx
Extension cable to adapter cable	–	✓[2)]	ID 749369-xx
Dummy plug for standard handwheels	✓	–	ID 271958-03
Dummy plug for handwheels with FS	–	✓	ID 271958-05

[1)] For cable lengths up to 20 m between MB and HRA 551 FS
[2)] For cable lengths up to 50 m between MB and HRA 551 FS

See also *Cable overview* on Page 23.

HR 130

Panel-mounted handwheel with ergonomic control knob.
It is attached to the MB 7x0 or the TE 7x5 either directly or via an extension cable.

HR 130	W/o detent	ID 540940-03
	With detent	ID 540940-01
Weight	Approx. 0.7 kg	

HR 130

HR 150

Panel-mounted handwheel with ergonomic control knob for connection to the **HRA 110** handwheel adapter.

HR 150	W/o detent	ID 540940-07
	With detent	ID 540940-06
Weight	Approx. 0.7 kg	

HR 150

HRA 110

Handwheel adapter for connection of up to three **HR 150** panel-mounted handwheels and two switches for axis selection and for selecting the interpolation factor. The first two handwheels are permanently assigned to axes 1 and 2. The third handwheel is assigned to the axes over a selection switch (accessory) or by machine parameters. The position of the second selection switch (accessory) is evaluated by the PLC, for example to set the proper interpolation.

HRA 110		ID 261097-04
Weight	Approx. 1.5 kg	

HRA 110

Selection switch	With turning knob and cable	ID 270908-xx

Selection switch

Snap-on keys

Overview

The snap-on keys make it easy to replace the key symbols. In this way, the machine operating panel and HR handwheel can be adapted to different requirements. The snap-on keys are available in packs of 5 keys.

Axis keys

Orange

	ID 330816-42		ID 330816-24		ID 330816-43		ID 330816-37
	ID 330816-26		ID 330816-36		ID 330816-38		
	ID 330816-23		ID 330816-25		ID 330816-45		

Gray

	ID 330816-95		ID 330816-69		ID 330816-0W		ID 330816-0R
	ID 330816-96		ID 330816-0G		ID 330816-0V		ID 330816-0D
	ID 330816-97		ID 330816-0H		ID 330816-0N		ID 330816-0E
	ID 330816-98		ID 330816-71		ID 330816-0M		ID 330816-65
	ID 330816-99		ID 330816-72		ID 330816-67		ID 330816-66
	ID 330816-0A		ID 330816-63		ID 330816-68		ID 330816-19
	ID 330816-0B		ID 330816-64		ID 330816-21		ID 330816-16
	ID 330816-0C		ID 330816-18		ID 330816-20		ID 330816-0L
	ID 330816-70		ID 330816-17		ID 330816-0P		ID 330816-0K

Machine functions

	ID 330816-0X		ID 330816-75		ID 330816-0T		ID 330816-86
	ID 330816-1Y		ID 330816-76		ID 330816-81		ID 330816-87
	ID 330816-30		ID 330816-77		ID 330816-82		ID 330816-88
	ID 330816-31		ID 330816-78		ID 330816-83		ID 330816-94
	ID 330816-32		ID 330816-79		ID 330816-84		ID 330816-0U
	ID 330816-73		ID 330816-80		ID 330816-89		ID 330816-91
	ID 330816-74		ID 330816-0S		ID 330816-85		ID 330816-3L

Spindle functions

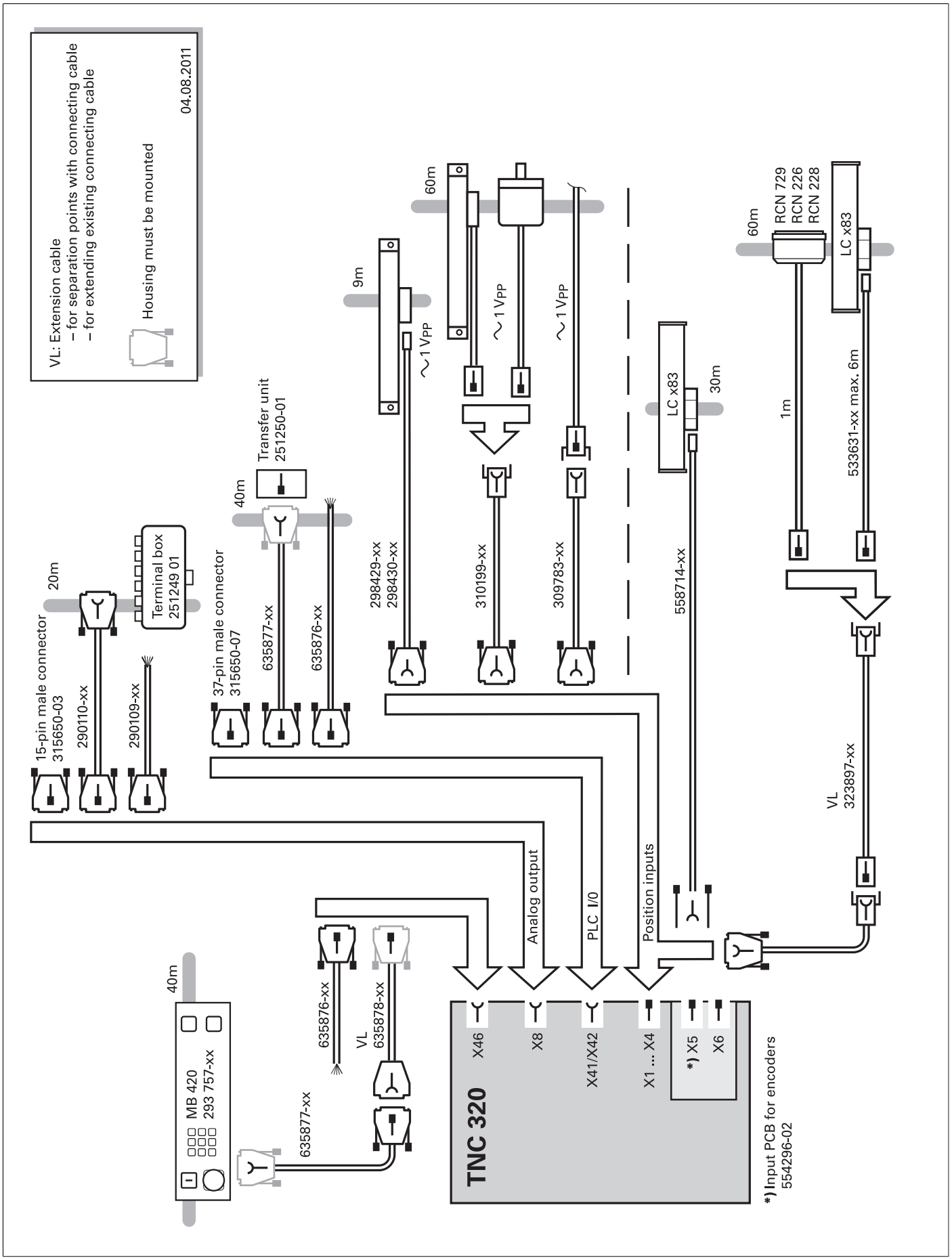
	ID 330816-08		ID 330816-40		ID 330816-47		ID 330816-48
	ID 330816-09		ID 330816-41		ID 330816-46		ID 385530-5X

Other keys

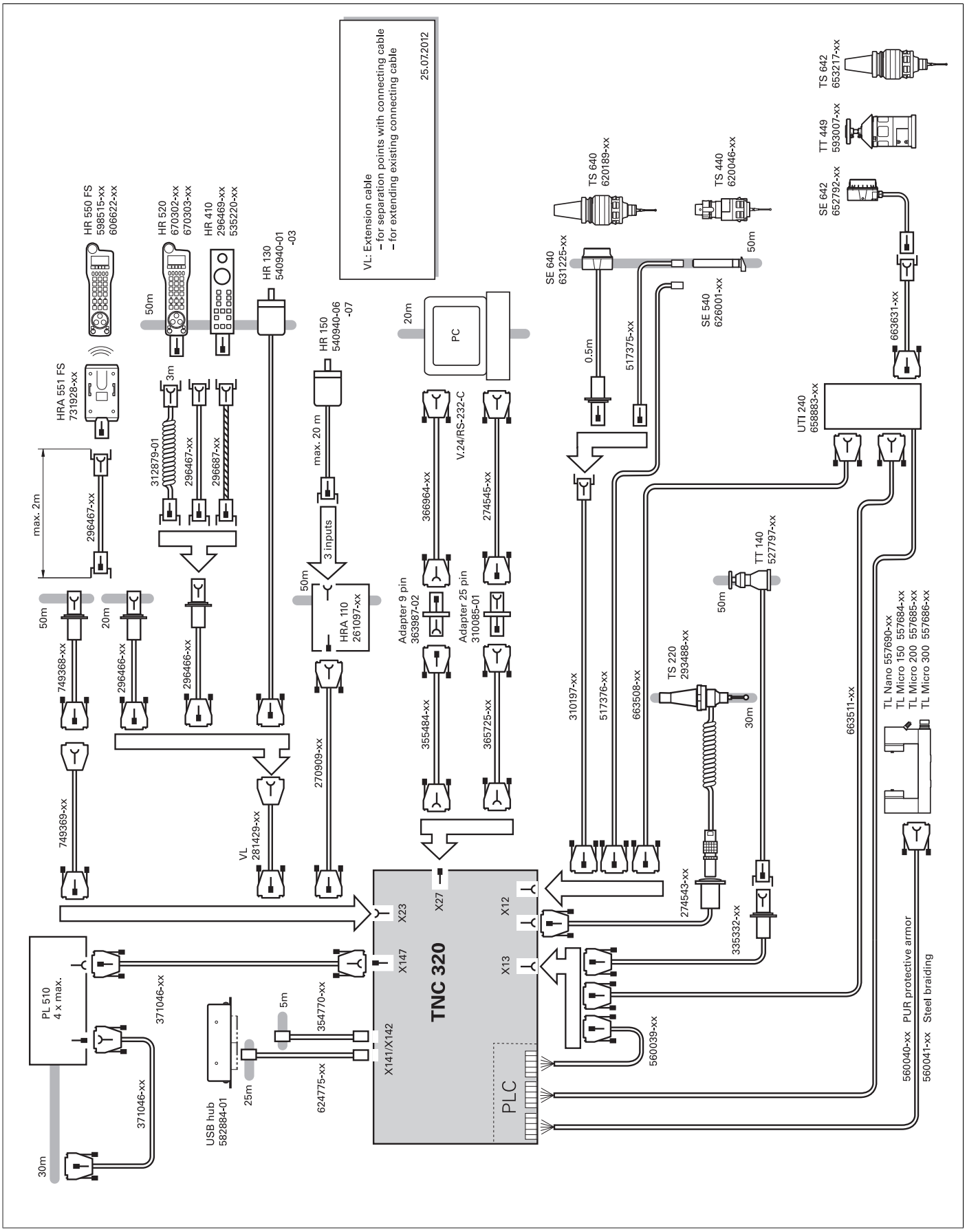
	ID 330816-01		ID 330816-50		ID 330816-90		ID 330816-93
	ID 330816-61		ID 330816-33		ID 330816-27		ID 330816-0Y
	ID 330816-11		ID 330816-34		ID 330816-28		ID 330816-4M
	ID 330816-12		ID 330816-35		ID 330816-29		ID 330816-3M
	ID 330816-49		ID 330816-22		ID 330816-92		ID 330816-3N

Cable overviews

TNC 320



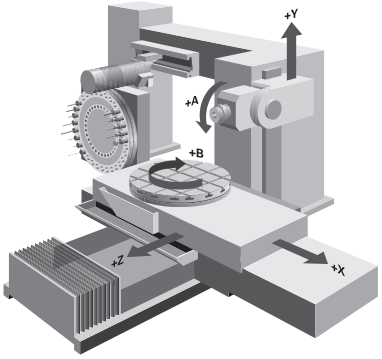
Accessories



Technical description
Axes

Linear axes

Depending on the options enabled, the TNC 320 can control linear axes with any axis designation (X, Y, Z, U, V, W ...).



Display and programming	–99 999.9999 to +99 999.9999 [mm]
	Feed rate in mm/min relative to the workpiece contour, or mm per spindle revolution
	Feed rate override: 0 % to 150 %
Traverse range	–99 999.9999 to +99 999.9999 [mm]
	The machine tool builder defines the traverse range. The user can set additional limits to the traverse range if he wishes to reduce the working space. Three different traverse ranges can be defined (selection by PLC).

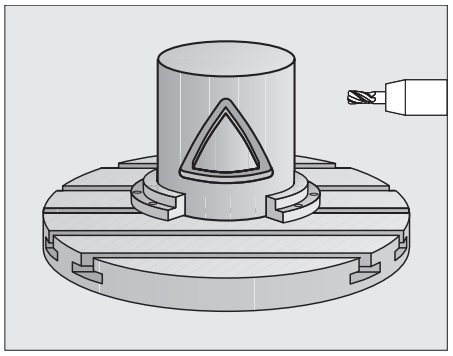
Rotary axes

The TNC 320 can control a rotary axis with any axis designation (A, B, C, U ...). Special parameters and PLC functions are available for rotary axes with Hirth coupling.

Display and programming	0° to 360° or –99 999.9999 to +99 999.9999 [°]
	Feed rate in degrees per minute [°/min]
Traverse range	–99 999.9999 to +99 999.9999 [°]
	The machine tool builder defines the traverse range. The user can set additional limits to the traverse range if he wishes to reduce the working space. Various traverse ranges can be defined per axis using parameter sets (selection by PLC).

Cylindrical surface interpolation (option 1)

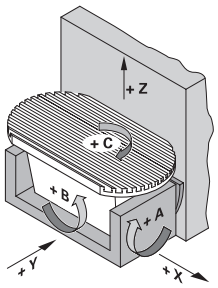
A contour defined in the working plane is machined on a cylindrical surface.



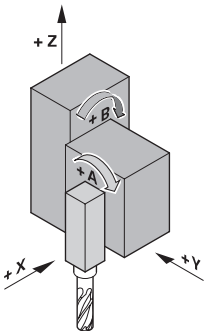
Tilting the working plane (option 1)

The TNC 320 has special coordinate transformation cycles for controlling swivel heads and tilting tables. The offset of the tilting axes and the tool lengths are compensated by the TNC.

The TNC can manage more than one machine configuration (e.g. different swivel heads).



Tilting table



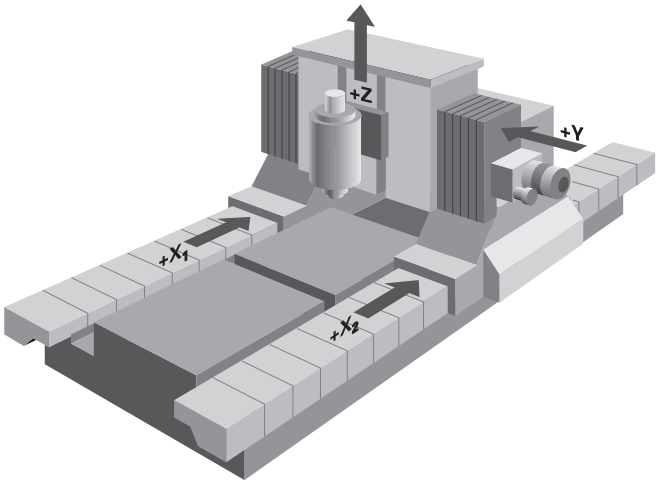
Swivel head

Synchronized axes (option 24)

Synchronized axes move in synchronism and are programmed with the same axis designation.

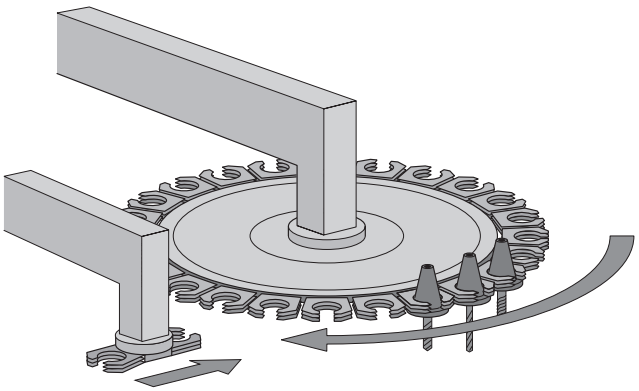
With HEIDENHAIN controls, parallel axis systems (gantry axes) such as on portal-type machines or tilting tables can be moved synchronously to each other through high-accuracy and dynamic position control.

With **gantry axes** more than one slave axis can be assigned to one master gantry axis. They may also be distributed to several controller units.



PLC axes

Axes can be controlled by the PLC. They are programmed through M functions or OEM cycles. The PLC axes are positioned independently of the NC axes and are therefore designated as asynchronous axes.



Spindle

Analog nominal speed value	Up to 100000 min^{-1}
Position-controlled spindle	The position of the spindle is monitored by the control.
Encoder	HEIDENHAIN rotary encoder with sinusoidal voltage signals (1 V_{PP}) or EnDat interface.
Tapping	There are special cycles for tapping with or without floating tap holder. For tapping without floating tap holder, the spindle must be operated under position control.
Oriented spindle stop	With a position-controlled spindle, the spindle can be positioned exactly to 0.1°.
Spindle override	0 to 150 %
Gear ranges	A specific nominal speed can be defined for each gear range. The gear ranges are controlled by the PLC.
Second spindle	Up to two spindles can be alternately controlled. You can switch from spindle 1 to spindle 2 through the PLC. Because the second spindle is controlled instead of an axis, the number of available axes is reduced by one.

Encoders

Overview

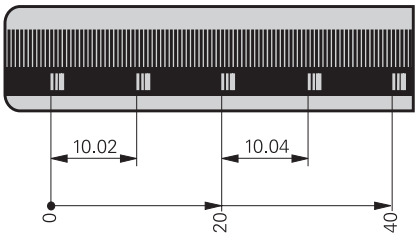
For speed and position control of the axes and spindle, HEIDENHAIN offers both incremental and absolute encoders.

Incremental encoders

Incremental encoders have as measuring standard a grating consisting of alternate lines and spaces. Relative movement between the scanning head and the scale causes output of sinusoidal scanning signals. The measured value is calculated from these signals.

Reference mark

When the machine is switched on, the machine axes need to traverse a reference mark for an accurate reference to be established between measured value and machine position. For encoders with distance-coded reference marks, the maximum travel until automatic reference mark evaluation for linear encoders is only 20 mm or 80 mm, depending on the model, or 10° or 20° for angle encoders.



Reference mark evaluation

The routine for traversing the reference marks can also be started for specific axes via the PLC during operation (reactivation of parked axes).

Output signals

Incremental encoders with sinusoidal output signals with levels ~ 1 V_{PP} are suitable for connection to HEIDENHAIN numerical controls.

Absolute encoders

With absolute encoders, the position information is contained in several coded tracks. Thus, an absolute reference is available immediately after switch-on. Reference-mark traverse is not necessary. Additional incremental signals are output for highly dynamic control loops.

EnDat interface

The TNC 320 features the serial EnDat 2.1 interface for the connection of absolute encoders.

Note: The EnDat interface on HEIDENHAIN encoders differs in its pin assignment from the interface on Siemens motors with integrated absolute ECN/EQN rotary encoders. Special adapter cables are available.

Encoder inputs for position control

Incremental and absolute linear, angular or rotary encoders from HEIDENHAIN can be connected to encoder inputs of the TNC 320.

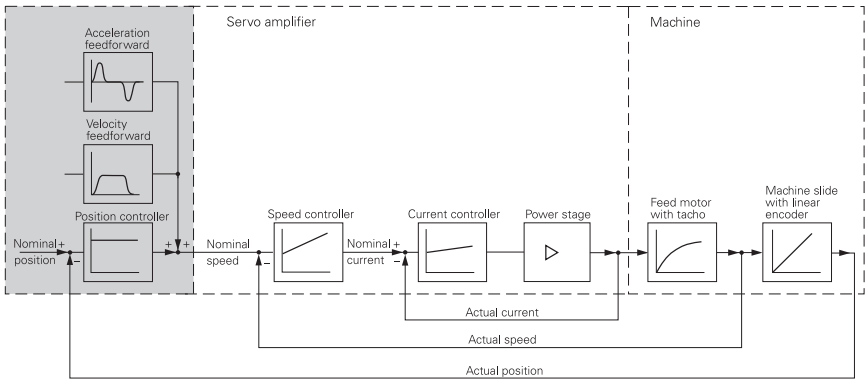
Inputs	**Signal level/Interface[1)]**	**Input frequency[1)]**
Incremental	~1 V_{PP}	33 kHz/350 kHz
Absolute	EnDat 2.1 ~1 V_{PP}	– 33 kHz/350 kHz

[1)] Switchable

Control

Analog speed command interface

The position controller is integrated in the TNC 320. The motor speed controller and the current controller are located in the servo amplifier. The TNC transmits the speed command signal through an analog ± 10 V interface (connection X8) to the servo amplifier.



Axis feedback control

The TNC 320 can be operated with following error or feedforward control.

Servo control with following error

The term "following error" denotes the distance between the momentary nominal position and the actual position of the axis. The velocity is calculated as follows:

$v = k_v \cdot s_a$

v = velocity
k_v = position loop gain
s_a = following error

Servo control with feedforward

Feedforward means that the speed and the acceleration are adjusted to fit the machine. Together with the values calculated from the following error, it forms the nominal value. This greatly reduces the following error (to within a few µm). The feedforward is adjustable from 0 to 100 % via a machine parameter.

Central drive

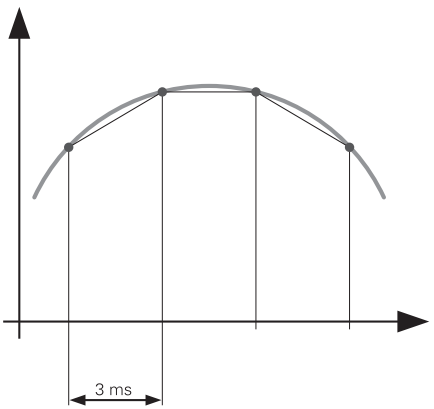
It is possible to use one common drive for several or all machine axes. The NC software allows the user to use the same nominal position value output for more than one axis.

The most important basic requirements for realizing a machine with central drive:

- Common drive package with an analog nominal position value input for all axes.
- The PLC must handle the machine axes as clamping axes.
- The PLC monitors the drive regarding movement in multiple axes and outputs an error message if necessary.

Control loop cycle times

The cycle time for **path interpolation** is defined as the time interval during which interpolation points on the path are calculated. The control-loop cycle time of the TNC 320 is 3 ms.



Axis clamping

The control loop can be opened through the PLC in order to clamp specific axes.

Block processing time

When running long programs from the internal memory, the TNC has a short block processing time of only 6 ms. This means that the TNC can even mill contours made of 0.5 mm line segments at feed rates as high as 5 m/min.

Look-ahead

The TNC calculates the geometry ahead of time in order to adjust the feed rate. In this way directional changes are detected in time to accelerate or decelerate the appropriate NC axes.

Jerk limiting

To prevent machine oscillations, the jerk is limited to attain optimum path control.

Open-loop axes

One or more axes can be defined as open-loop axes (manually operated axes, counter axes). They have position encoders for determining and displaying the current position value, but no nominal-value outputs. The target position is approached by the machine operator manually (e.g. via mechanical handwheels). When an NC block with an open-loop axis is reached during machining, a dialog window appears, prompting the machine operator to traverse the axis to the nominal coordinates.

Monitoring functions

Description

During operation the control monitors the:
- Amplitude of the encoder signals
- Edge separation of the encoder signals
- Absolute position for encoders with distance-coded reference marks
- Current position (following error monitoring)
- Actual path traversed (movement monitoring)
- Position deviation at standstill
- Checksum of safety-related functions
- Supply voltage
- Buffer battery voltage
- Operating temperature of the MC and CPU
- Running time of the PLC program

In the case of hazardous errors, an EMERGENCY STOP message is sent to the external electronics via the control-is-ready output, and the axes are brought to a stop. The correct connection of the TNC 320 in the machine's EMERGENCY STOP loop is checked when the control system is switched on. In the event of an error, the control displays a message in plain language.

Context-sensitive help

The HELP and ERR keys provide the user with context-sensitive help. This means that in the event of an error message, the control displays information on the cause of the error and proposes solutions. The machine tool builder can also use this function for PLC error messages.

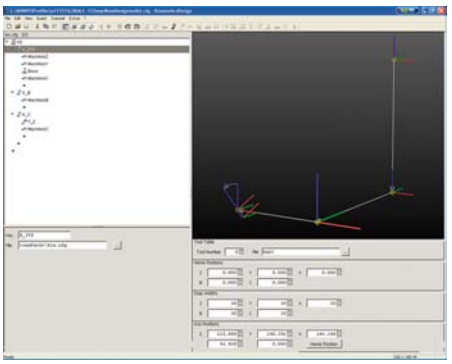
KinematicsDesign (accessory)

KinematicsDesign is a PC program for creating adaptable kinematic configurations. It supports:
- Complete kinematic configurations
- Transfer of configuration files between control and PC

When used with the iTNC 530, KinematicsDesign provides further conveniences:
- Assignment table
- Kinematics description table
- Kinematics subfile description table
- Tool-carrier kinematics description table
- Definition table for collision-monitored objects (CMO)
- Initial and subsequent configuration of Dynamic Collision Monitoring (DCM; option 40)

If KinematicsDesign is connected with a control online (operation is also possible with the programming station software), then machine movements can be simulated graphically along with axis traverse. With the iTNC 530, when DCM is active the working space is also simulated and any collisions or collision-endangered components of defined objects are displayed in a definable color.

Depending on the control involved, the visualization capabilities range from the pure depiction of the transformation sequence to wire models or, on the iTNC, to a complete representation of the working envelope.



Error compensation

Overview

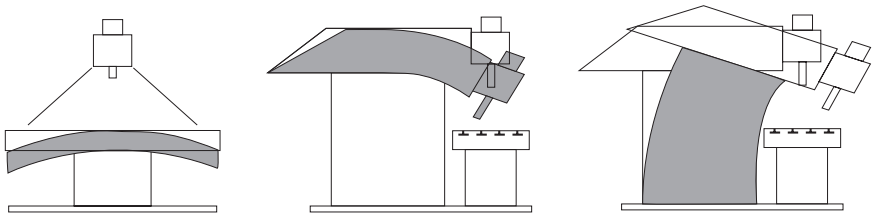
The TNC automatically compensates mechanical errors on the machine.

Linear error

Linear error can be compensated over the entire travel range for each axis.

Nonlinear error

The TNC can compensate for ball-screw pitch errors and sag errors simultaneously. The compensation values are stored in a table. A separate backlash can also be entered for each measuring point (outside of the controlled system).



Backlash

The play between table movement and rotary encoder movement on direction changes can be compensated in length measurements by spindle and rotary encoder. This backlash is outside the controlled system.

Thermal expansion

To compensate thermal expansion, the machine's expansion behavior must be known.

The temperature can be recorded via thermistors connected to the analog inputs of the TNC. The PLC evaluates the temperature information and transfers the compensation value to the NC.

Commissioning and diagnostic aids

Overview

The TNC 320 provides internal commissioning and diagnostic aids.

ConfigDesign (accessory)

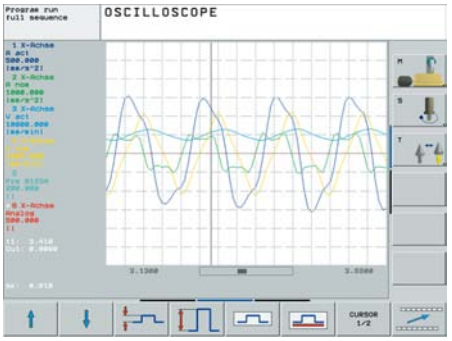
PC software for configuring the machine parameters
- Machine-parameter editor for the control; all support information; additional data and input limits are shown for each parameter
- Configuration of machine parameters
- Comparison of parameters from different controls
- Importing of service files: easy testing of machine parameters in the field
- Rule-based creation and management of machine configurations for multiple controls (together with PLCdesign)

Online Monitor (OLM)

The online monitor is a component part of the TNC 320 and is called over a code number. It supports commissioning and diagnosis of control components by:
- Display of control-internal variables for axes and channels
- Display of controller-internal variables (if a CC is present)
- Display of hardware signal states
- Various trace functions
- Activation of spindle commands
- Enabling control-internal debug outputs

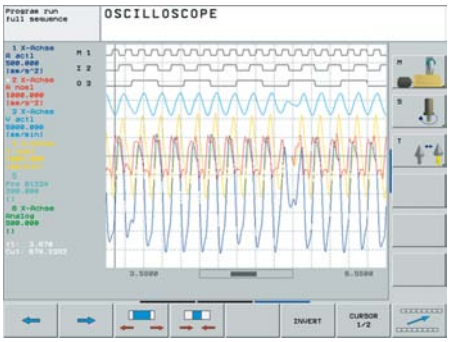
Oscilloscope

The TNC 320 features an integrated oscilloscope. Both X/t and X/Y graphs are possible. The following characteristic curves can be recorded and saved in six channels:
- Actual value and nominal value of the axis feed rate
- Contouring feed rate
- Actual position
- Nominal position
- Following error of the position controller
- Nominal values for speed, acceleration and jerk
- Actual values for speed, acceleration and jerk
- Nominal value of analog output
- Content of PLC operands
- Encoder signal (0° – A) and (90° – B)



Logic signals

Simultaneous graphic representation of the logic states of up to 16 operands (markers, words, inputs, outputs, counters, timers)
- Marker (M)
- Input (I)
- Output (O)
- Timer (T)
- Counter (C)
- IpoLogik (X)



Commissioning wizard

In order to simplify the adaptation of the axes and spindle, the Commissioning Wizard for analog axes guides you step-by-step through the commissioning of any axis parameter set. You can define the following machine parameters with the aid of the Commissioning Wizard:
- Ascertain the algebraic sign of the axis
- Ascertain the axis traverse direction
- Ascertain the velocity at an analog voltage of 9 V
- Ascertain the maximum acceleration of the axis
- Ascertain the k_v factor of the axis
- Ascertain acceleration feedforward control for the axis

TNCscope (accessory)

PC software for transferring the oscilloscope files to a PC.
Note: The trace files are saved in the TNCscope data format.

API DATA

The API DATA function enables the control to display the states or contents of the symbolic API markers and API double words. This function requires that your PLC program use the symbolic memory interface.
Note: The API DATA function does not provide usable display values with the iTNC 530-compatible memory interface (API 1.0).

Table function

The current conditions of the markers, words, inputs, outputs, counters and timers are displayed in tables. The conditions can be changed through the keyboard.

Trace function

The current content of the operands and the accumulators is shown in the statement list in each line in HEX or decimal code. The active lines of the statement list are marked.

Log

For the purposes of error diagnostics, all error messages and keystrokes are recorded in a log. The entries can be read using the **PLCdesign** or **TNCremo** software for PCs.

TeleService (accessory)

PC software for remote diagnostics, remote monitoring and remote operation of the control. For more information, please ask for the *Remote Diagnosis with TeleService* Technical Information sheet.

Integrated PLC

Overview

The PLC program is created by the machine manufacturer either at the control (with an external PC keyboard with USB connection) or with the PLC development software **PLCdesign** (accessory). Machine-specific functions are activated and monitored via the PLC inputs/outputs. The number of PLC inputs/outputs required depends on the complexity of the machine.

PLC expansion

If the PLC inputs/outputs of the TNC 320 are insufficient, the external PL 510 PLC input/output system can be connected.

Rated operating current

MC main computer: 0.15 A per output
PL 510/PL 550: see *PLC inputs/outputs*

PLC programming

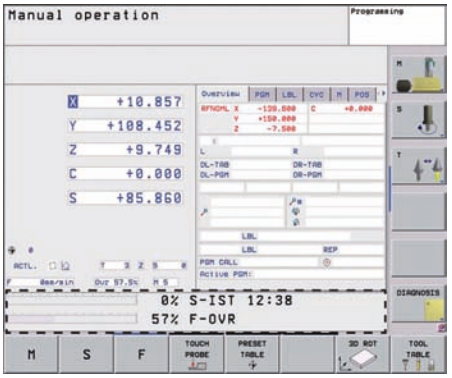
Format	Statement list
Memory	50 MB
Cycle time	Typically 21 ms, adjustable
Command set	• Bit, byte and word commands • Logical operations • Arithmetic commands • Comparisons • Nested calculations (parentheses) • Jump commands • Subprograms • Stack operations • Submit programs • 952 timers • 48 counters • Comments • PLC modules • 100 strings

PLC window

PLC error messages can be displayed by the TNC in the dialog line during operation.

Small PLC window

The TNC can show additional PLC messages and bar diagrams in the small PLC window.



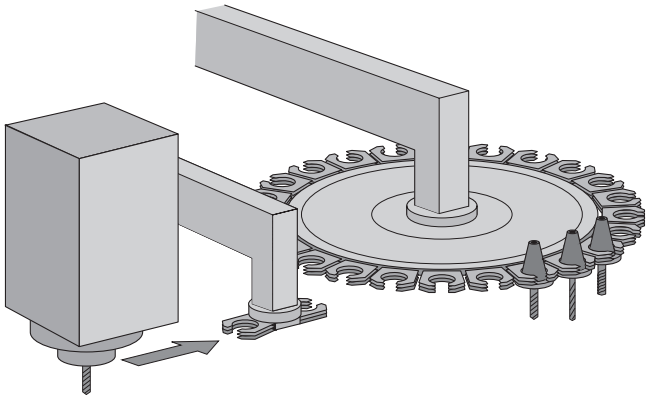
Small PLC window

PLC soft keys

The machine manufacturer can display his own PLC soft keys in the vertical soft-key row on the screen.

PLC positioning

All closed-loop axes can be also positioned via the PLC. PLC positioning of the NC axes cannot be superimposed on NC positioning.



PLC axes

Axes can be controlled by the PLC. They are programmed by M functions or OEM cycles. The PLC axes are positioned independently of the NC axes.

PLCdesign (accessory)

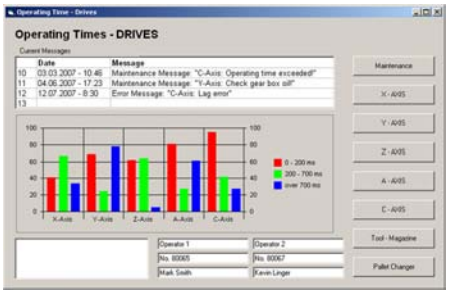
PC software for PLC program development.
The PC program **PLCdesign** can be used for easy creation of PLC programs. Comprehensive examples of PLC programs are included with the product.

Functions:
- Easy-to-use text editor
- Menu-guided operation
- Programming of symbolic operands
- Modular programming method
- "Compiling" and "linking" of PLC source files
- Operand commenting, creation of the documentation file
- Comprehensive help system
- Data transfer between the PC and control
- Creation of PLC soft keys

PC requirements:
- Windows 2000/XP/Vista/7 operating system
- At least 20 MB free memory on the hard disk
- Serial interface; Ethernet interface recommended
- Internet Explorer

Python OEM Process (option 46)

The Python OEM Process option is an effective tool for the machine tool builder to use an object-oriented high-level programming language in the control (PLC). Python is an easy-to-learn script language that supports the use of all necessary high-level language elements.



Python OEM Process can be universally used for machine functions and complex calculations, as well as to display special user interfaces. User-specific or machine-specific solutions can be efficiently implemented. Numerous libraries on the basis of Python and GTK are available, regardless of whether you want to create special algorithms for special functions, or separate solutions such as an interface for machine maintenance software.

The applications created can be included via the PLC in the familiar PLC windows, or they can be displayed in separate free windows that can be expanded to the TNC's full screen size.

PLC basic program

The PLC basic program serves as a basis for adapting the control to the requirements of the respective machine. It can be downloaded from the Internet.

These essential functions are covered by the PLC basic program:

- Controlling all axes
- Clamped axes
- Homing the axes; reference end positions
- Positioning the axes after reference run
- Compensating the axis temperature
- Feed rate control
- Controlling and orienting the spindle
- Tool changer
- Vertical PLC soft-key row
- Displaying and managing PLC error messages
- Status display in the small PLC window
- Hydraulic control
- Control of the coolant system (internal, external, air)
- M functions
- Lubrication
- Chip conveyor
- Operation of the second spindle alternately with the first
- S-coded spindle
- Positioning the spindle as an axis
- Operation with clamped axes
- Axes with central drive
- Axes with Hirth grid
- Indexing fixture
- PLC log
- Touch probes
- PLC support for handwheels
- Control of doors

Interfacing to the machine

OEM cycles

The machine tool builder can create and store his own cycles for recurring machining tasks. These OEM cycles are used in the same way as standard HEIDENHAIN cycles.

CycleDesign (accessory)

The soft-key structure for the cycles is managed using the **CycleDesign** PC program. In addition, CycleDesign can be used to store help graphics and soft keys in BMP format in the TNC. Graphic files can be compressed to ZIP format to reduce the amount of memory used.

Tool management

With integral PLC, the tool changer is moved either via proximity switch or as a controlled axis. Tool management including tool life monitoring and replacement tool monitoring is carried out by the TNC 320.

Tool measurement

Tools can be measured and checked using the **TT** or **TL** tool touch probes (accessory). The control features standard cycles for automatic tool measurement. The control calculates the probing feed rate and the optimal spindle speed. The measured data is stored in a tool table.

Touch-probe configuration

All touch-probe data can be configured conveniently through a table. All HEIDENHAIN touch probe systems are preconfigured and can be selected through a drop-down menu.

Data transfer and communication
Data interfaces

Overview	The TNC is connected to PCs, networks and other data storage devices via data interfaces.
Ethernet	The TNC can be interconnected via the Ethernet interface. The TNC features a 100BaseT (Twisted Pair Ethernet) connection to the data network. Maximum transmission distance: Unshielded 100 m Shielded 400 m
Protocol	The TNC communicates using the TCP/IP protocol.
Network connection	• NFS file server • Windows networks (SMB)
Data transfer rate	Approx. 40 to 80 Mbps (depending on file type and network utilization)
RS-232-C/V.24	Data interface according to DIN 66 020 or EIA standard RS-232-C. Maximum transmission distance: 20 m
Data transfer rate	115 200; 57 600; 38 400; 19 200; 9600; 4800; 2400; 1200; 600; 300; 150; 110 Bit/s
Protocols	The TNC can transfer data using various protocols.
Standard data transfer	The data is transferred character by character. The number of data bits, stop bits, the handshake and character parity must be set by the user.
Blockwise data transfer	The data is transferred blockwise. A block check character (BCC) is used to ensure data integrity. This method improves data security.
LSV2	Bidirectional transfer of commands and data as per DIN 66 019. Before being transferred the data are split into telegrams (blocks).
Adapter block	For connecting the interface to the electrical cabinet or operating panel **RS-232-C/V.24 adapter** 9-pin ID 363987-02 25-pin ID 310085-01
USB	The TNC 320 features three USB 2.0 ports for the connection of standard USB devices, such as the mouse, drives, etc. Two are on the back of the control, and one is on the front. A cover cap protects them from contamination. The USB ports are rated for a maximum of 0.5 A.
USB cable	Cable length up to 5 m ID 354770-xx Cable length 6 m to 30 m with integrated amplifier; USB 1.1. ID 624775-xx

USB hub

If you need further USB ports or if the supply current is not sufficient, a USB hub is required. The USB hub from HEIDENHAIN offers four free USB ports.

USB hub ID 582884-02
Power supply 24 V DC / max. 300 mA

Cover

The USB hub can be installed in the operating panel in such a way that two USB ports can be accessed from the outside. An optionally available cover cap can be used to protect the ports from contamination.

Cover ID 508921-01

Software for data transfer

For transfer of files between the TNC and PC, we recommend using HEIDENHAIN software.

TNCremo (accessory)

This PC software package helps the user to transfer data from the PC to the control. The software transfers data blockwise with block check characters (BCC).

Functions:
- Data transfer (also blockwise)
- Remote control (only serial)
- File management and data backup of the control
- Reading out the log
- Print-out of screen contents
- Text editor
- Managing more than one machine

Requirements:
- Windows 2000/XP/Vista/7 operating system
- At least 10 MB free hard-disk space
- Serial or Ethernet interface

TNCremoPlus (accessory)

In addition to the features you are already familiar with from TNCremo, TNCremoPlus can also transfer the current content of the control's screen to the PC (live screen). This makes it very simple to monitor the machine.

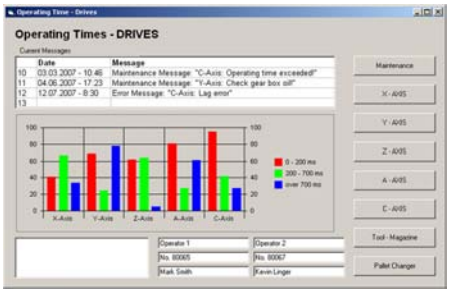
TNCremoPlus ID 340447-xx

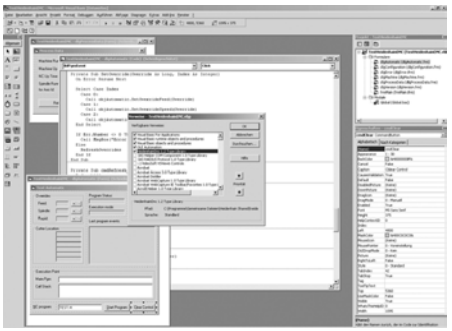
DNC applications

Overview

The development environments on Windows operating systems are particularly well suited as flexible platforms for application development in order to come to terms with the increasingly complex requirements of the machine's environment. The flexibility of the PC software and the large selection of ready-to-use software components and standard tools in the development environment enable you to develop PC applications of great use to your customers in a very short time, for example:

- Error reporting systems that, for example, send the customer a text message to his cell phone reporting problems on the currently running machining process
- Standard or customer-specific PC software that decidedly increases process security and equipment availability
- Software solutions controlling the processes of manufacturing systems
- Information exchange with job management software





HEIDENHAIN DNC (option 18)

The HEIDENHAIN DNC software interface is an attractive communication platform for this purpose. It provides all the data and configuration capabilities needed for these processes so that an external PC application can evaluate data from the control and, if required, influence the manufacturing process.

RemoTools SDK (accessory)

To enable you to use HEIDENHAIN DNC effectively, HEIDENHAIN offers the RemoTools SDK development package. It contains the COM components and the ActiveX control for integration of the DNC functions in development environments.

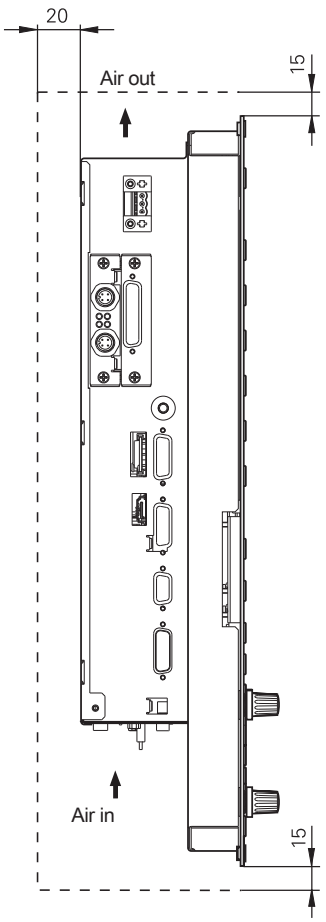
RemoTools SDK ID 340442-xx

For more information, refer to the *HEIDENHAIN DNC* brochure.

Mounting information
Clearances and mounting

Proper minimum clearance

When mounting the control components, please observe proper minimum clearances, space requirements, length and position of the connecting cables.



Leave space for air circulation and servicing

Mounting and electrical installation

Remember the following during mounting and electrical installation:

- National regulations for power installations
- Interference and noise immunity
- Operating conditions
- Mounting attitude

Degrees of protection

The following components fulfill the requirements for IP 54 (dust protection and splash-proof protection):

- TNC 320 (when properly installed)
- Machine operating panel (when properly installed)
- Handwheel

Electromagnetic compatibility

Protect your equipment from interference by observing the rules and recommendations specified in the Technical Manual.

Intended place of operation

This unit fulfills the requirements for EN 50370-1 and is intended for operation in industrially zoned areas.

Likely sources of interference

Interference is produced by capacitive and inductive coupling from electrical conductors or from device connections, such as:

- Strong magnetic fields from transformers or electric motors
- Relays, contactors and solenoid valves
- High-frequency equipment, pulse equipment and stray magnetic fields from switch-mode power supplies
- Power lines and leads to the above equipment

Protective measures

- Keep a minimum distance of 20 cm from the MC, CC and its leads to devices that carry interference signals
- Keep a minimum distance of 10 cm from the MC, CC and its leads to cables that carry interference signals. For cables in metallic ducting, adequate decoupling can be achieved by using a grounded separation shield.
- Shielding according to EN 50 178
- Use equipotential bonding conductors with a cross section of 6 mm^2
- Use only genuine HEIDENHAIN cables and connecting elements

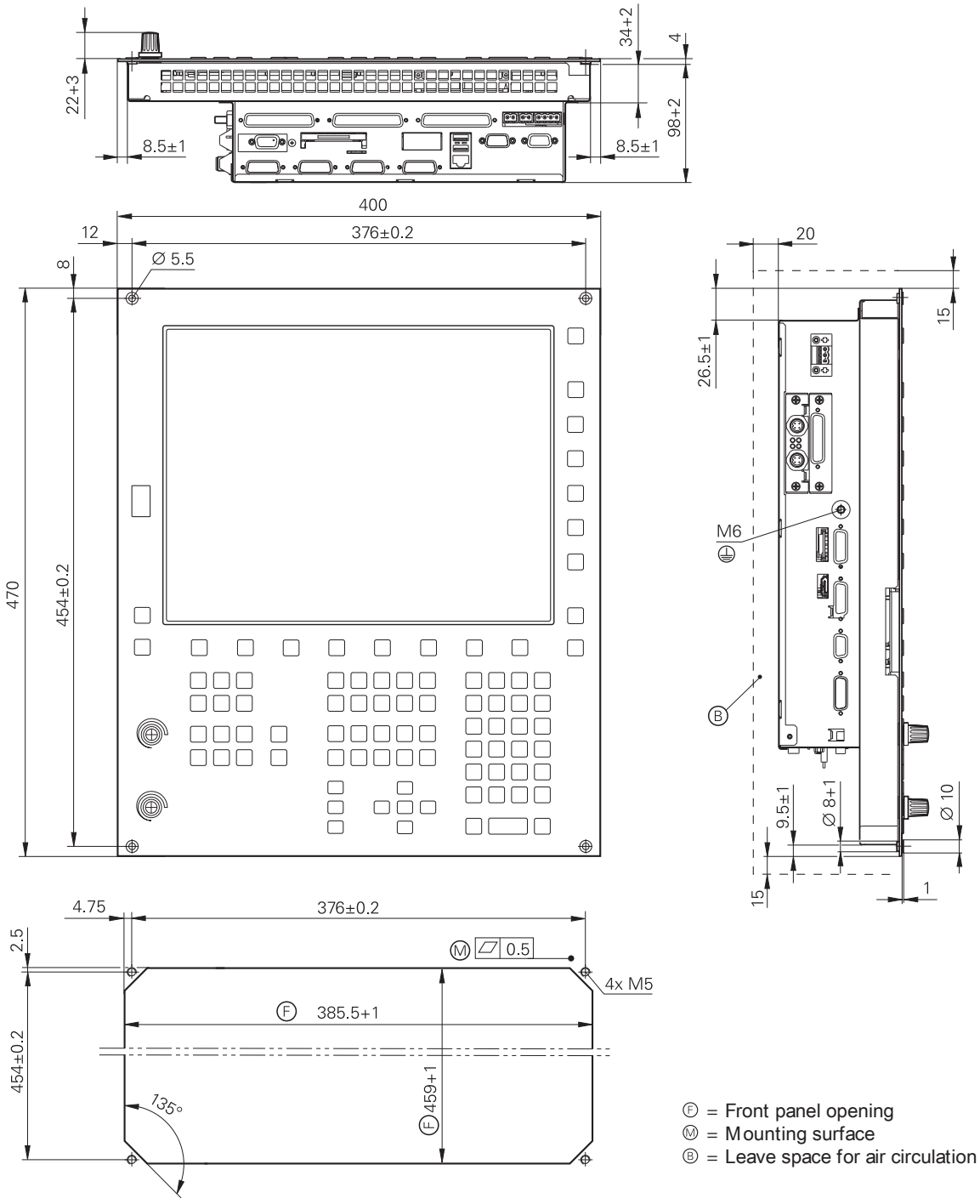
Overall dimensions

Main computer

TNC 320

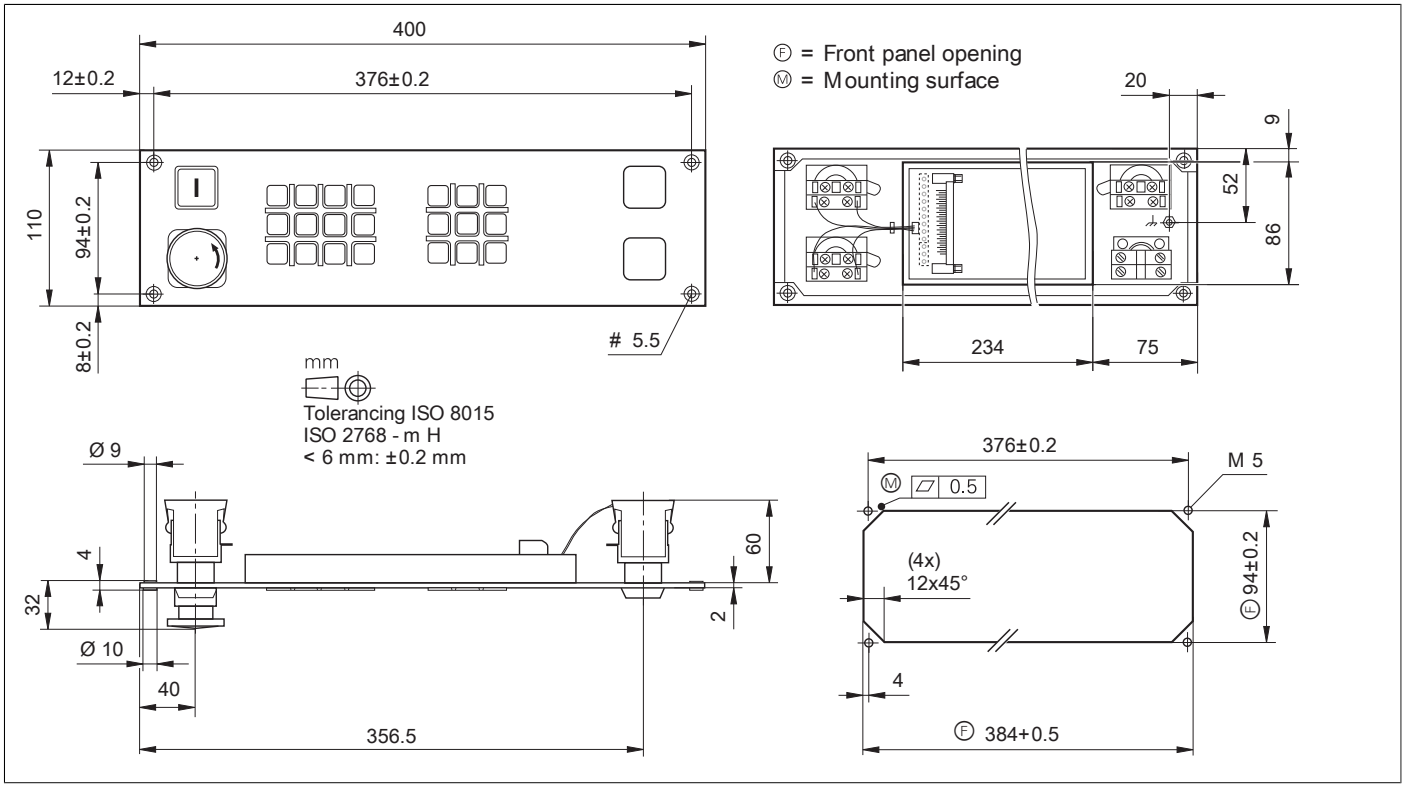
mm

Tolerancing ISO 8015
ISO 2768 - m H
< 6 mm: ±0.2 mm



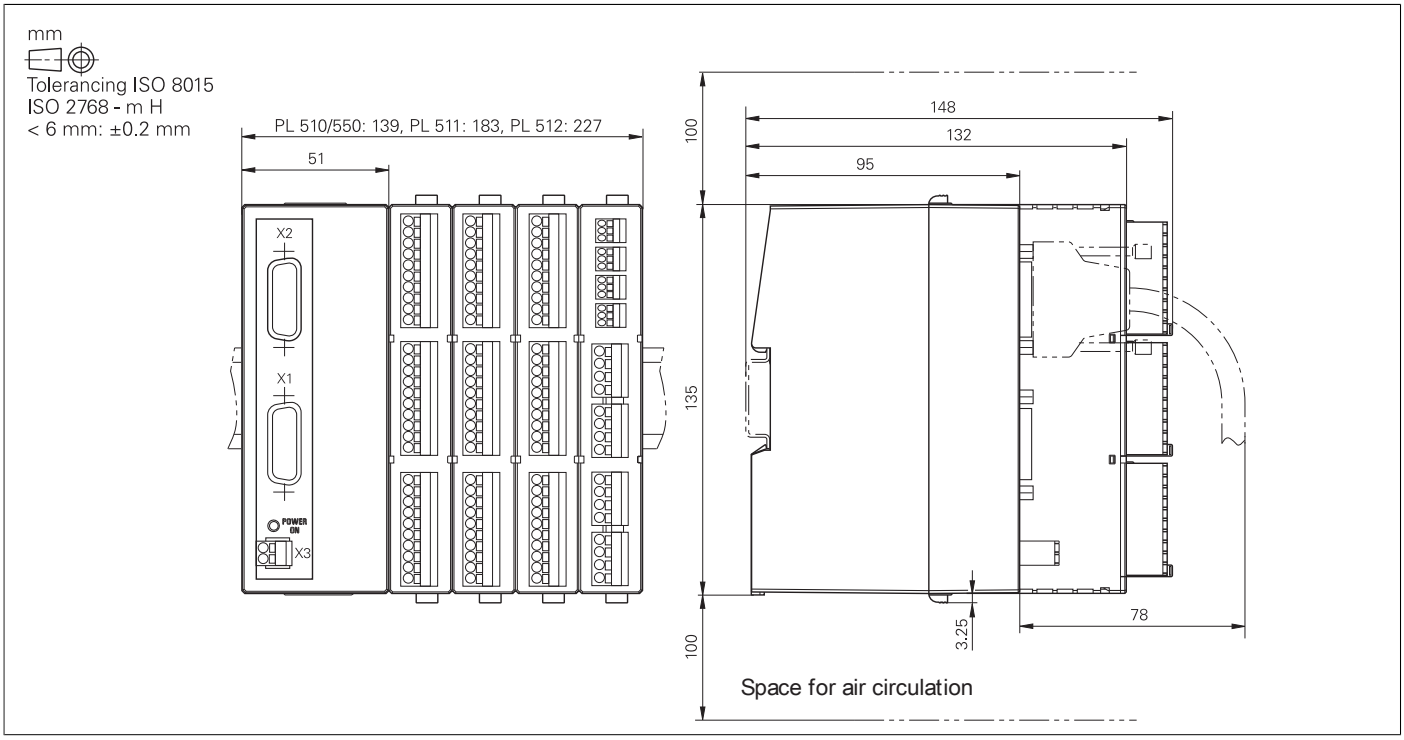
Monitor and keyboard

MB 420



PLC inputs and outputs

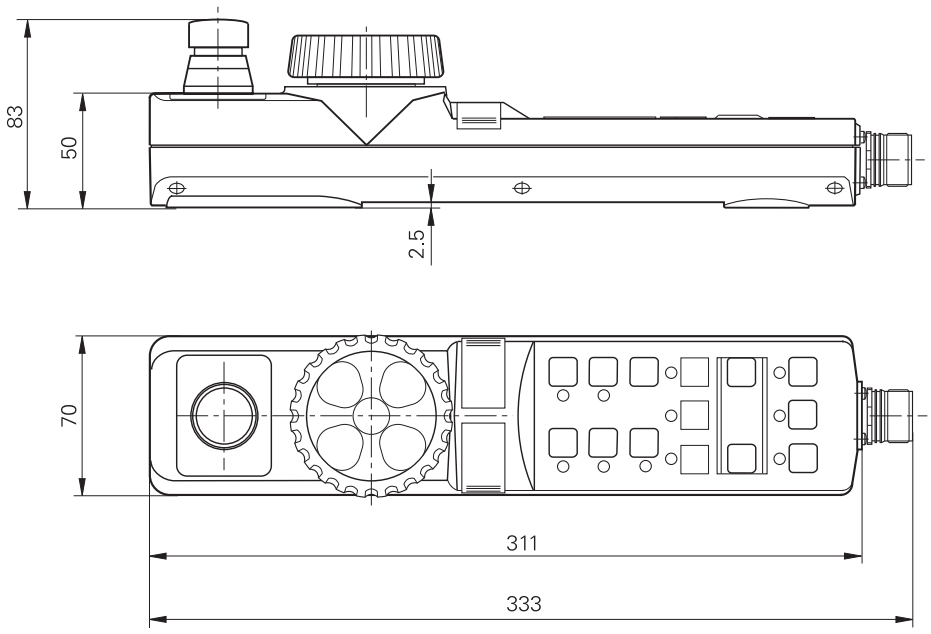
PL 510



Electronic handwheels

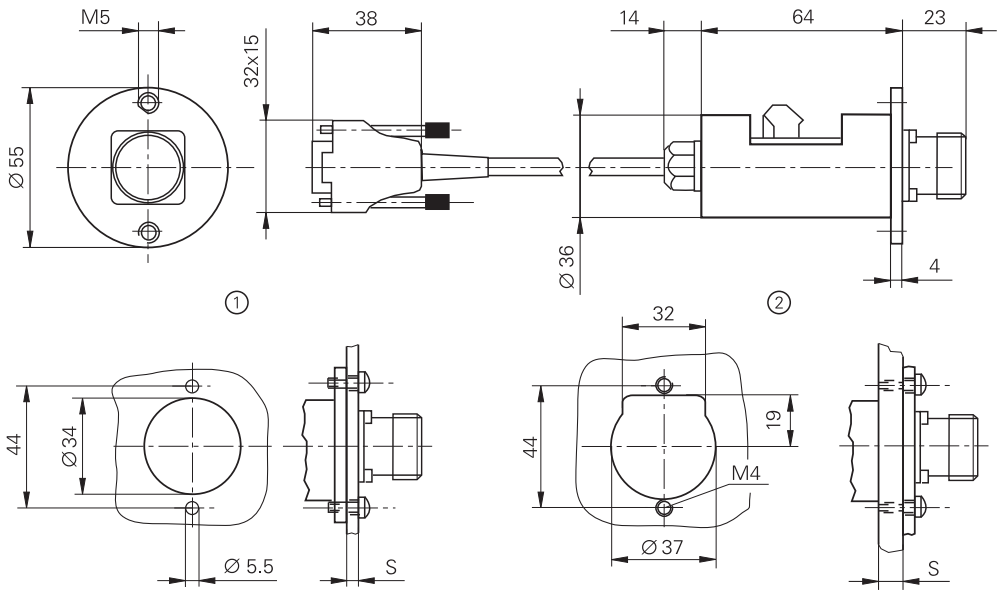
HR 410

mm
Tolerancing ISO 8015
ISO 2768 - m H
< 6 mm: ±0.2 mm



Adapter cable for HR 410 and HR 520

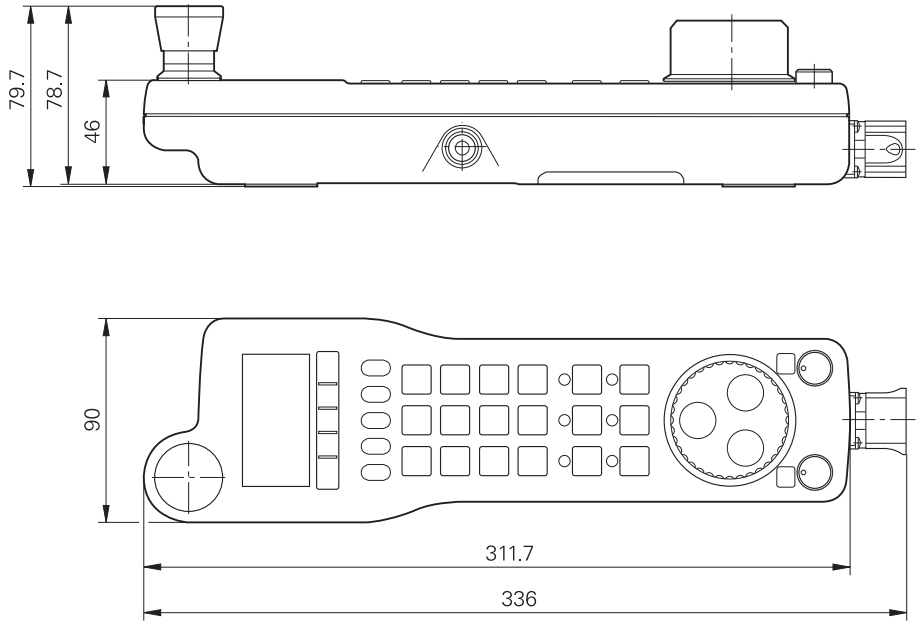
mm
Tolerancing ISO 8015
ISO 2768 - m H
< 6 mm: ±0.2 mm



① Mounting opening up to wall thickness S = 4
② Mounting opening for wall thickness S = 4 or more

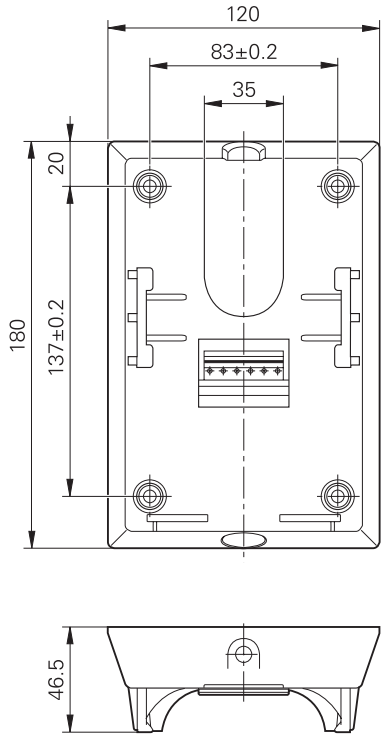
HR 520

mm
Tolerancing ISO 8015
ISO 2768 - m H
< 6 mm: ±0.2 mm



Mount for HR 520

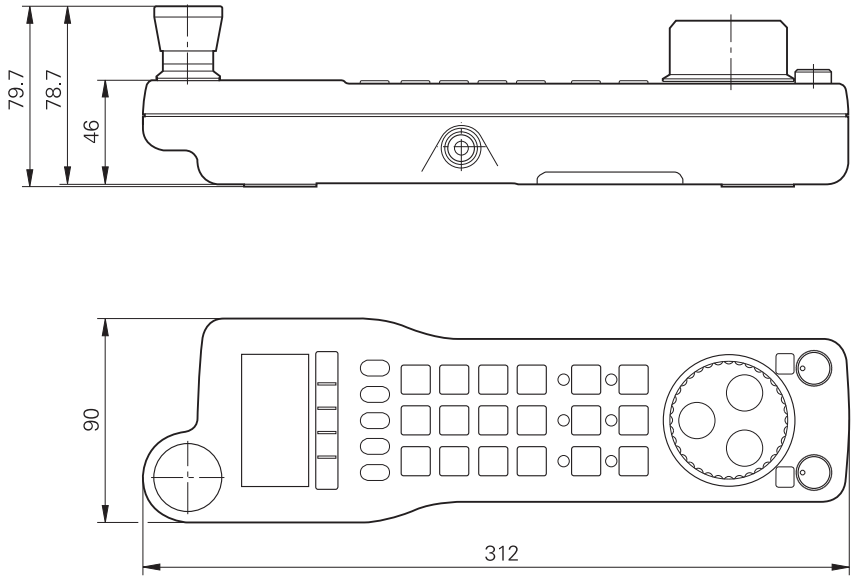
mm
Tolerancing ISO 8015
ISO 2768 - m H
< 6 mm: ±0.2 mm



HR 550 FS

mm

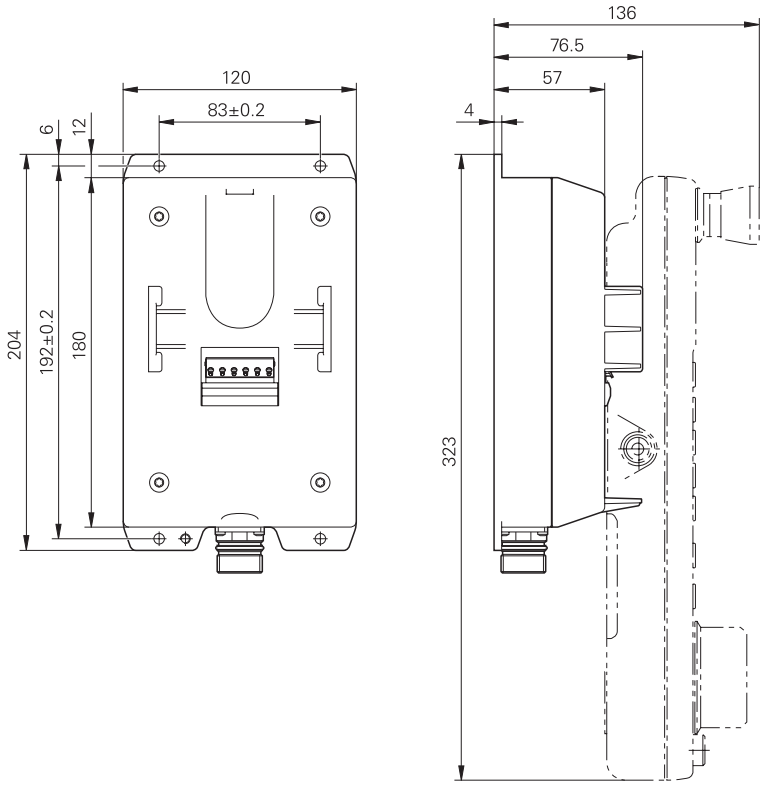
Tolerancing ISO 8015
ISO 2768 - m H
< 6 mm: ±0.2 mm



HRA 551 FS

mm

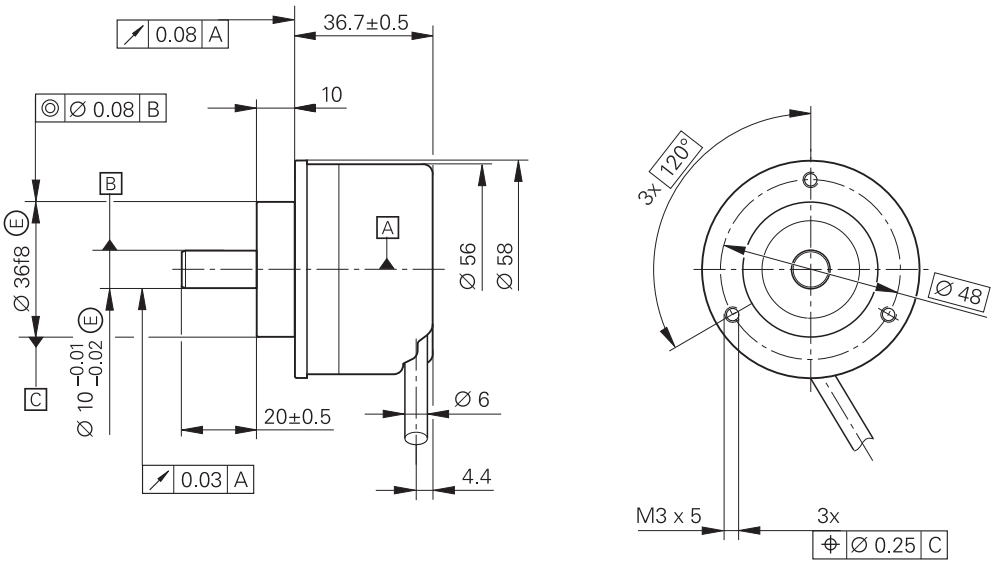
Tolerancing ISO 8015
ISO 2768 - m H
< 6 mm: ±0.2 mm

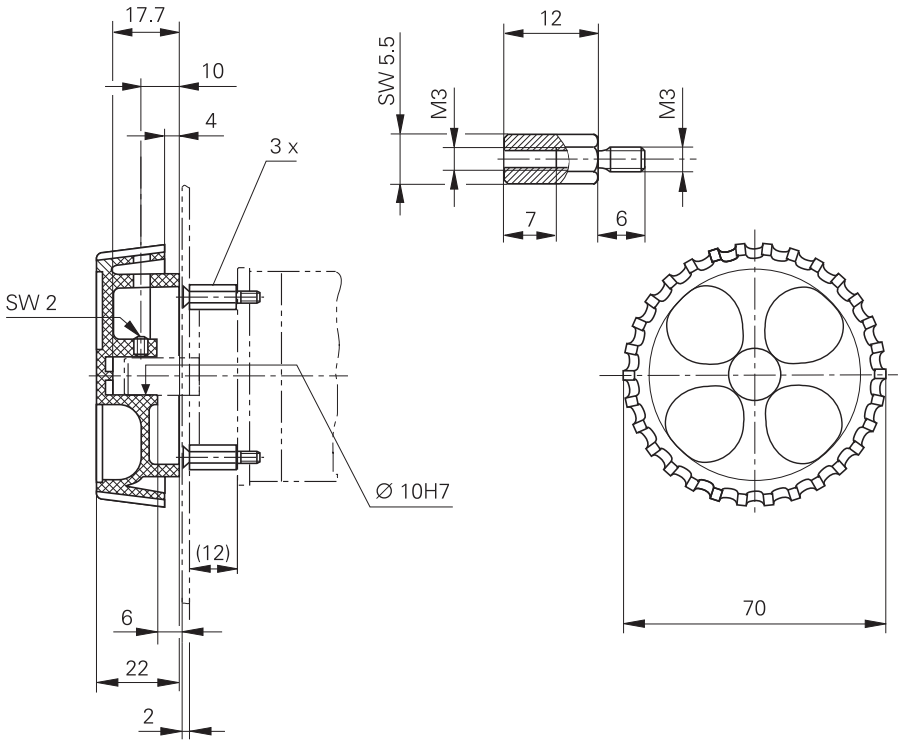


HR 130, HR 150 with control knob

mm

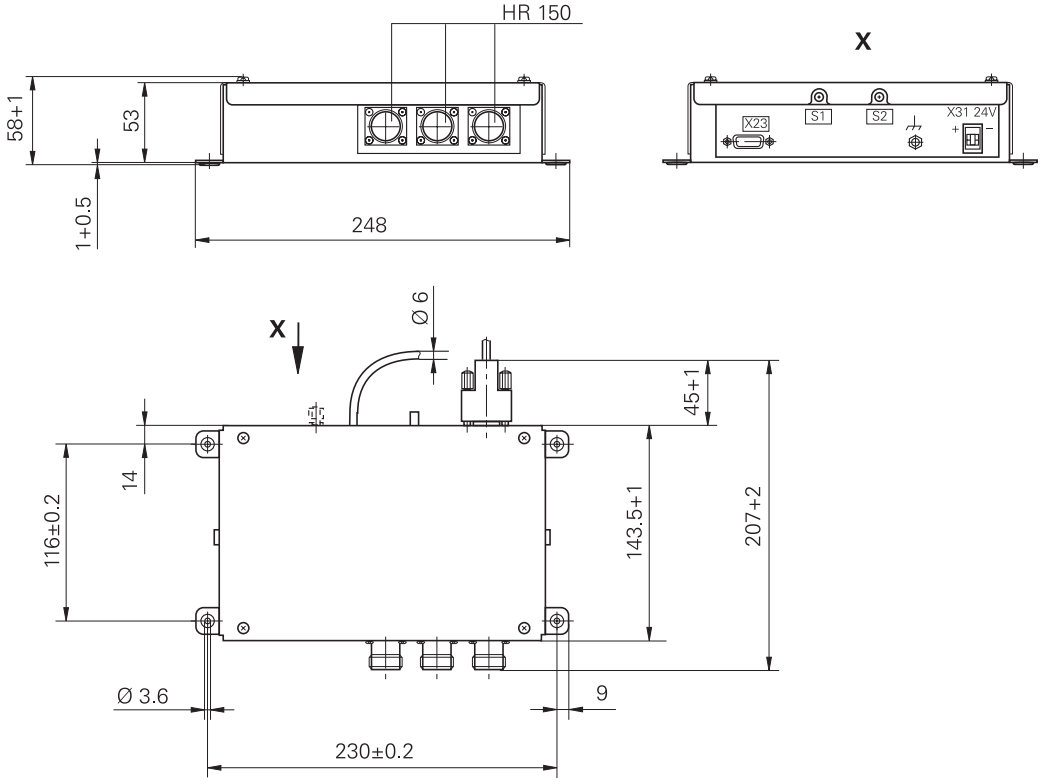
Tolerancing ISO 8015
ISO 2768 - m H
< 6 mm: ±0.2 mm





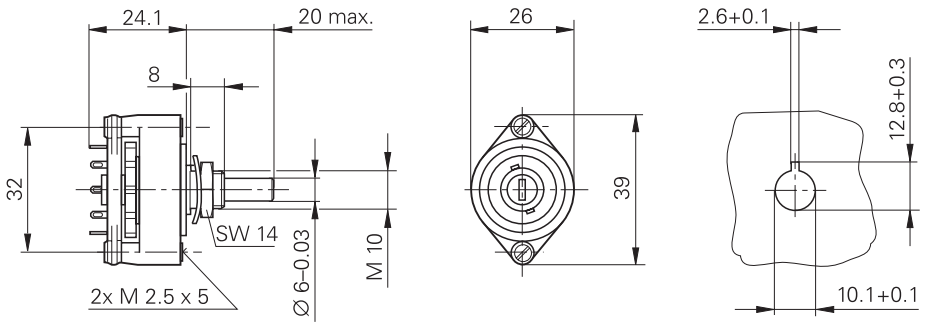
HRA 110

mm
Tolerancing ISO 8015
ISO 2768 - m H
< 6 mm: ±0.2 mm



Selection switch

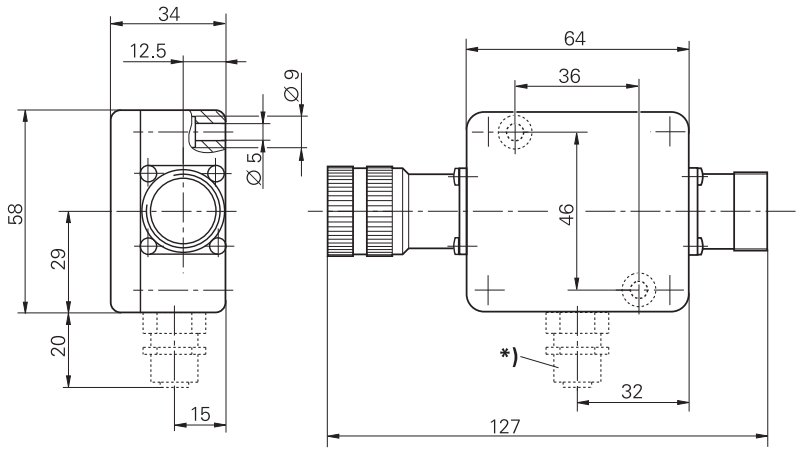
mm
Tolerancing ISO 8015
ISO 2768 - m H
< 6 mm: ±0.2 mm



Interface accessories

Line drop compensator for encoders with EnDat interface

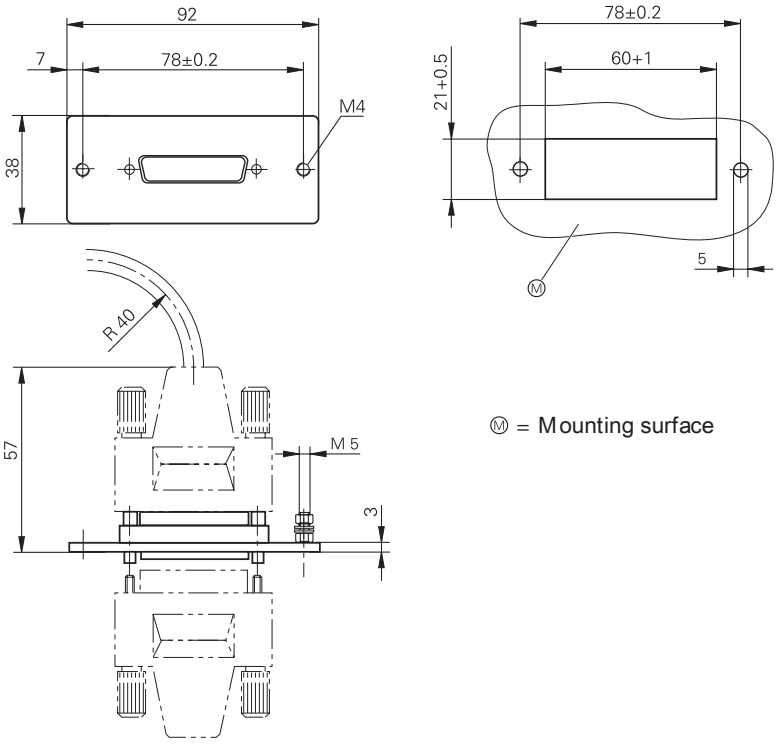
mm
Tolerancing ISO 8015
ISO 2768 - m H
< 6 mm: ±0.2 mm



*) Connection to KTY

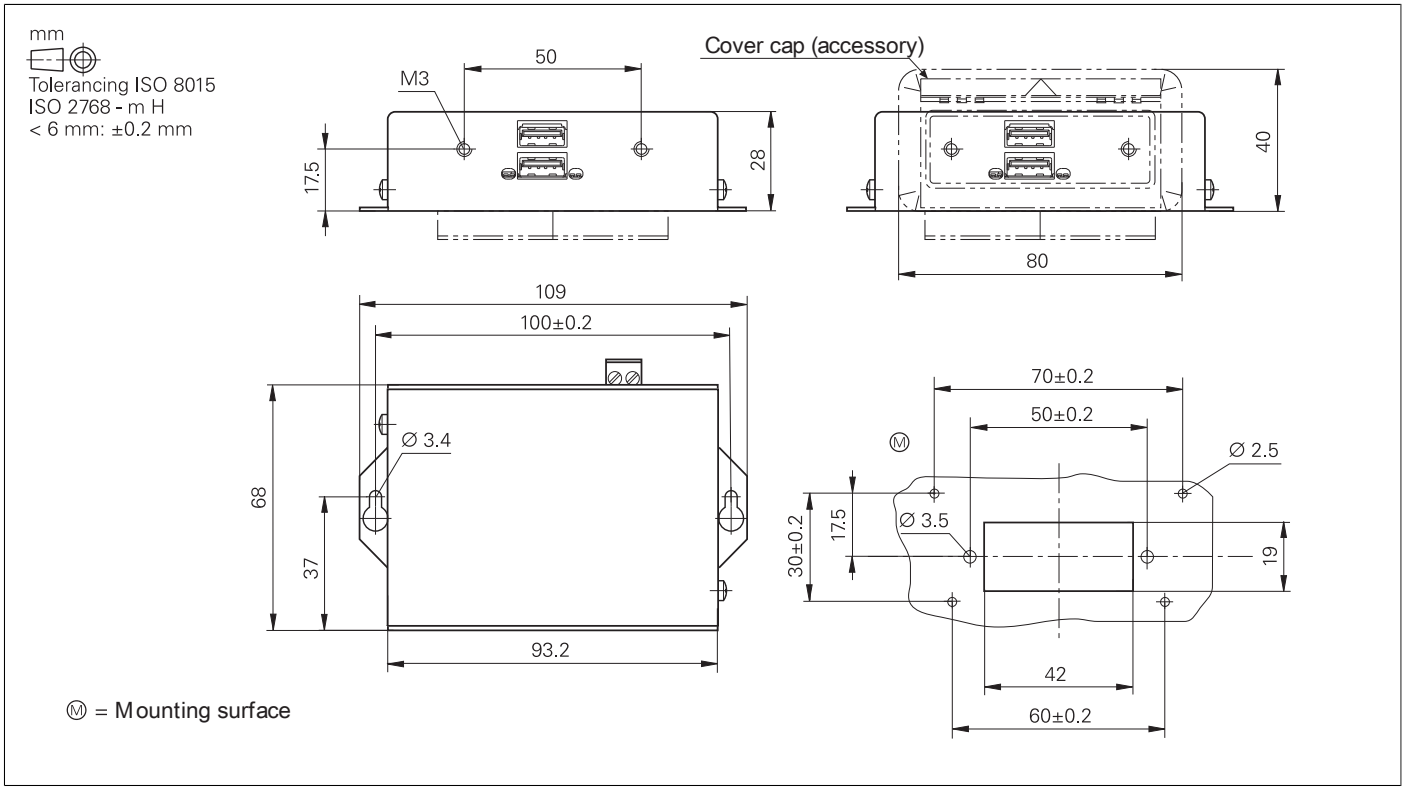
RS-232-C adapter

mm
Tolerancing ISO 8015
ISO 2768 - m H
< 6 mm: ±0.2 mm

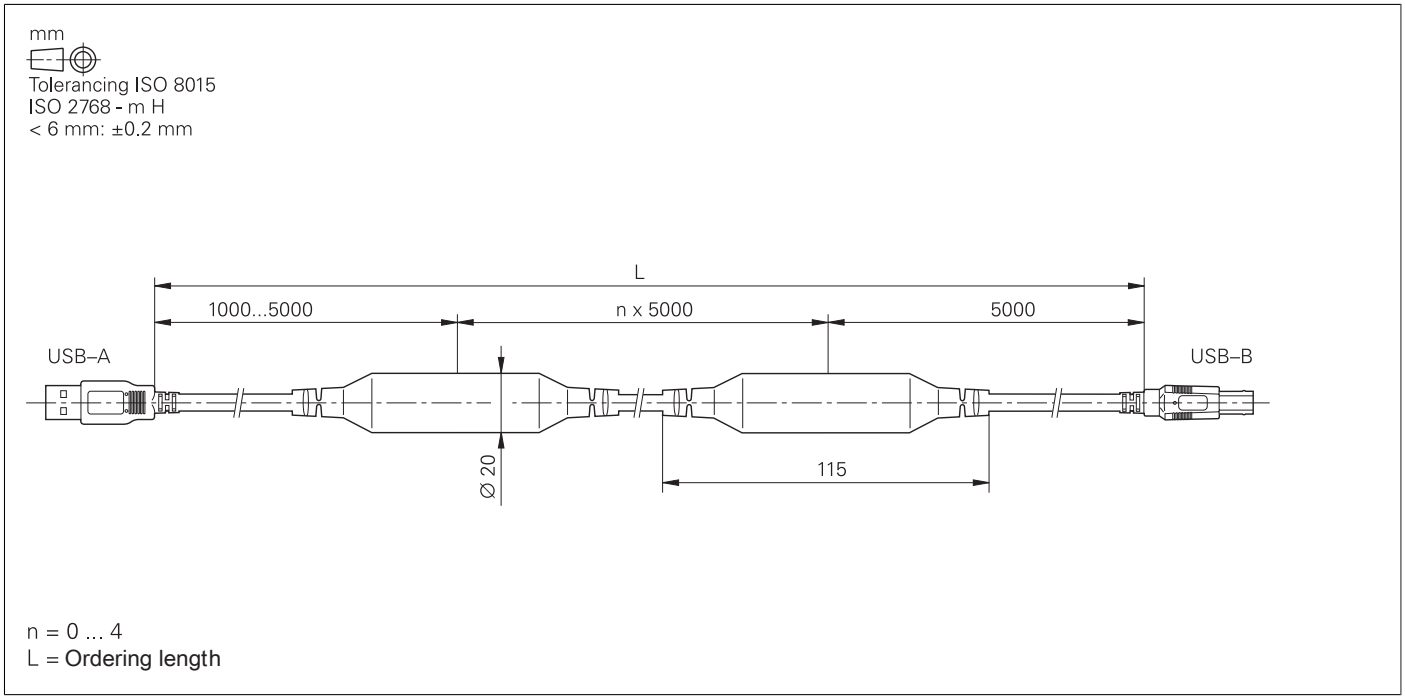


Ⓜ = Mounting surface

USB hub



USB extension cable with hubs



General information
Documentation

Technical documentation	• **TNC 320** Technical Manual	ID 583525-xx; in PDF format on HESIS-Web including Filebase
	• **TS 220** Mounting Instructions	ID 312821-91
	• **TS 440** Mounting Instructions	ID 632756-9x
	• **TS 444** Mounting Instructions	ID 632757-9x
	• **TS 640** Mounting Instructions	ID 632760-9x
	• **TS 740** Mounting Instructions	ID 632761-9x
	• **TT 140** Mounting Instructions	ID 297510-xx
	• **TT 449** Mounting Instructions	ID 664914-xx
User documentation	**TNC 320**	
	• **Conversational Programming** User's Manual	ID 679222-xx
	• **Cycle Programming** User's Manual	ID 679220-xx
	• **DIN/ISO** User's Manual	ID 679226-xx
	Miscellaneous	
	• **TNCremo** User's Manual	As integrated help
	• **TNCremoPlus** User's Manual	As integrated help
	• **PLCdesign** User's Manual	As integrated help
	• **CycleDesign** User's Manual	As integrated help
	• **KinematicsDesign** User's Manual	As integrated help
Other documentation	• **TNC 320** brochure	ID 551025-xx
	• **Touch Probes** brochure	ID 208951-xx
	• **HEIDENHAIN DNC** brochure	ID 628968-xx
	• **Remote Diagnosis with TeleService** Product Overview	ID 348236-xx
	• **Touch Probes** CD-ROM	ID 344353-xx
	• **TNC 320/TNC 620 Programming Station Demo Version** CD-ROM	ID 741708-xx
	• **HR 550 FS** Product Information	PDF

Service and training

Technical support

HEIDENHAIN offers the machine manufacturer technical support to optimize the adaptation of the TNC to the machine, including on-site support.

Replacement control system

In the event of a fault, HEIDENHAIN guarantees the rapid supply of a replacement control system (usually within 24 hours in Europe).

Hotline

Our service engineers are naturally at your disposal by telephone if you have any questions on the interfacing of the control or in the event of faults.

TNC support	+49 8669 31-3101 E-mail: service.nc-support@heidenhain.de
PLC programming	+49 8669 31-3102 E-mail: service.plc@heidenhain.de
NC programming	+49 8669 31-3103 E-mail: service.nc-pgm@heidenhain.de
Measuring systems	+49 8669 31-3104 E-mail: service.ms-support@heidenhain.de
Lathe controls	+49 8669 31-3105 E-mail: service.lathe-support@heidenhain.de

Machine calibration

On request, HEIDENHAIN engineers will calibrate your machine's geometry, e.g. with a KGM grid encoder.

Seminars

HEIDENHAIN provides technical customer training in the following subjects:

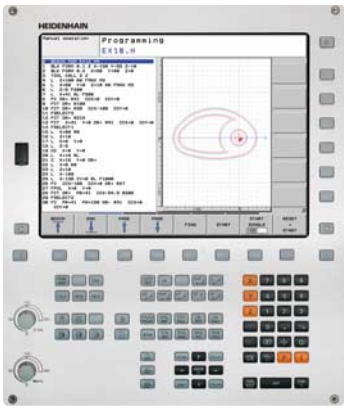
- NC programming
- PLC programming
- TNC optimization
- TNC service
- Encoder service
- Special training for specific customers

For more information on dates, registration, etc. call in Germany:
+49 8669 31-2293 or 31-1695
+49 8669 31-1999
E-mail: mtt@heidenhain.de
www.heidenhain.de

Other HEIDENHAIN controls
Examples

TNC 620

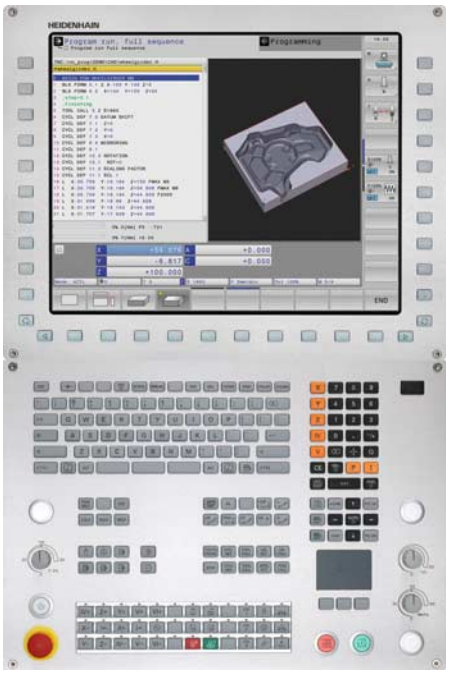
Information:
TNC 620 brochure



- Contouring control for **milling machines**
- Up to 5 axes and closed-loop main spindle
- HEIDENHAIN inverter systems and motors recommended
- Uniformly digital with HSCI interface and EnDat interface
- Compact design:
  - Screen, keyboard and main computer housed in one unit (MC 7110)
  - Screen and main computer housed in one unit (MC 7120) and separate keyboard with integrated ASCII keys
- Dimensions: 400 mm x 470 mm x 100 mm
- Integrated 15-inch TFT color flat-panel display
- Storage medium for NC programs: CompactFlash memory card
- Programming in HEIDENHAIN conversational format or according to DIN/ISO
- Standard milling, drilling and boring cycles
- Touch probe cycles
- Short block processing time (1.5 ms)

TNC 640

Information:
TNC 640 brochure

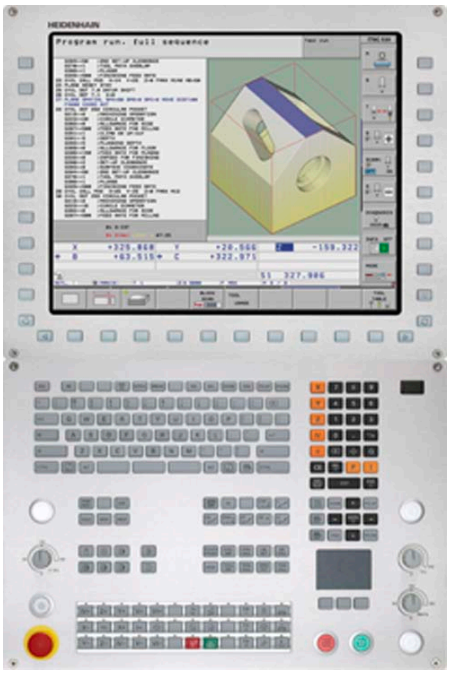


- Contouring control for **milling and milling/turning machines**
- Up to 18 axes and closed-loop main spindle
- HEIDENHAIN inverter systems and motors recommended
- Uniformly digital with HSCI interface and EnDat interface
- 19-inch TFT color flat-panel display
- Storage medium: HDR hard disk with 160 GB or SSDR solid state disk with 32 GB
- Programming in HEIDENHAIN conversational format or according to DIN/ISO
- Comprehensive cycle package for milling and turning operations
- Constant surface speed
- Tool-tip radius compensation
- Touch probe cycles
- FK free contour programming
- Special function for fast 3-D machining
- Short block processing time (0.5 ms)

iTNC 530

Information:
iTNC 530 brochure

- Contouring control for **milling, drilling and boring machines, and machining centers**
- Up to 18 axes and closed-loop main spindle
- HEIDENHAIN inverter systems and motors recommended
- Uniformly digital with HSCI interface and EnDat interface
- TFT color flat-panel display, 19-inch or 15-inch
- Storage medium: HDR hard disk with 160 GB / SSDR solid state disk with 32 GB
- Programming in HEIDENHAIN conversational format, with smarT.NC or according to DIN/ISO
- Standard milling, drilling and boring cycles
- Touch probe cycles
- FK free contour programming
- Special functions for fast 3-D machining
- Short block processing time (0.5 ms)
- Automatic calculation of cutting data
- Pallet management



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